April 25, 1950 G. E. FRANCK 2,505,665

TUBE CLAMPING MEANS

Filed May 4, 1946 2 Sheets-Sheet 1

Fig. 1

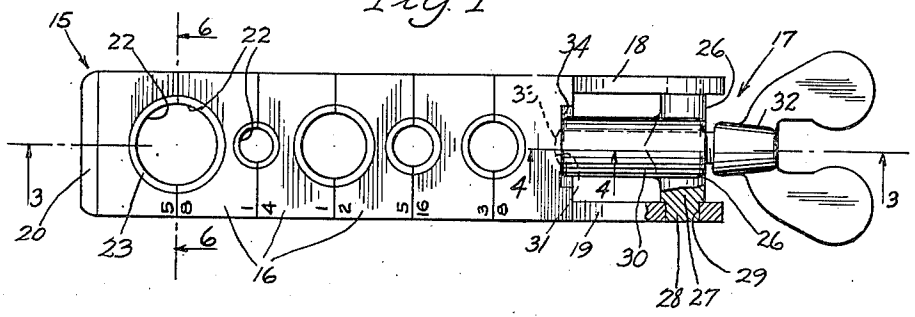


Fig. 2

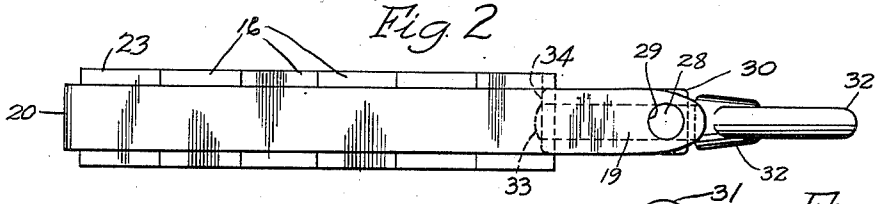


Fig. 3

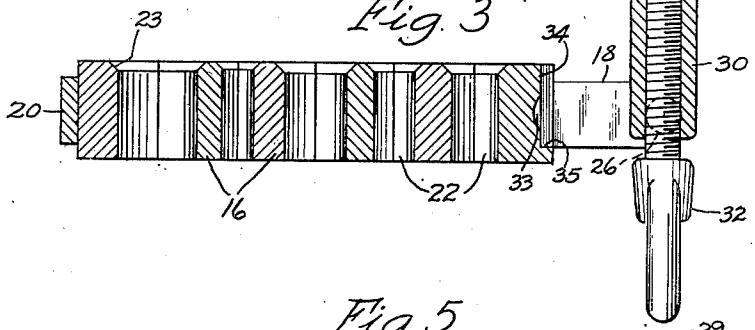


Fig. 4

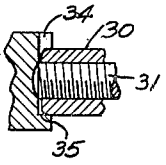


Fig. 5

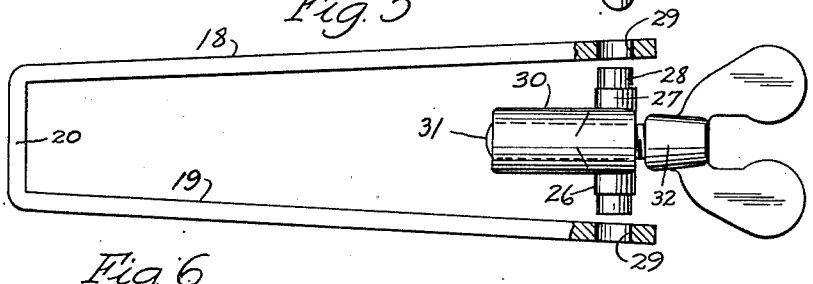
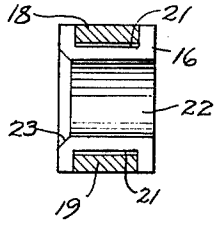


Fig. 6



Inventor
George E. Franck

By Chittick, Schroeder, Merriam & Hoffman
Attorneys

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Fig. 7

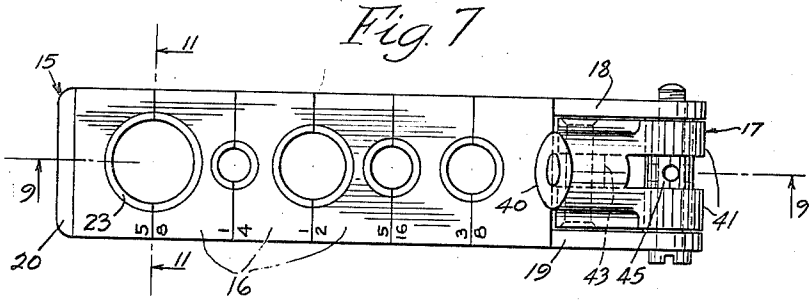


Fig. 8

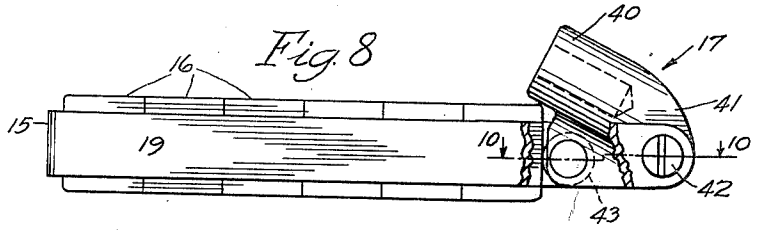


Fig. 9

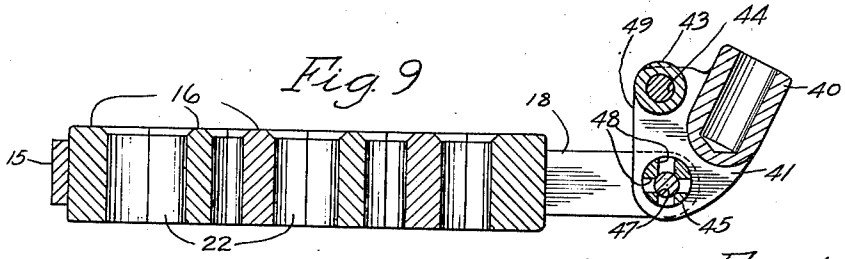


Fig. 10

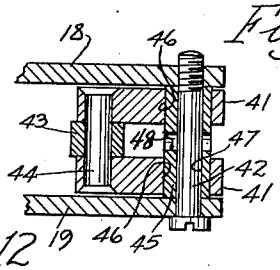


Fig. 11

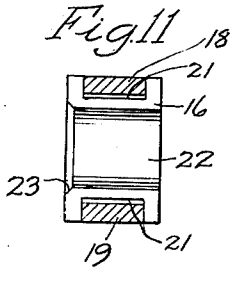
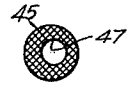


Fig. 12



Inventor
George E. Franck

By Christy, Schneider, Merriam & Hofgren
Attorneys

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TUBE CLAMPING MEANS

George E. Franck, Riverside, Ill., assignor to The Imperial Brass Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application May 4, 1946, Serial No. 667,386

4 Claims. (Cl. 29—284)

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The invention relates to tube clamping means for use as part of a tube flaring tool or the like and has as a general object to provide clamping means of new and improved construction.

Tube clamping means for use as part of a flaring tool or the like must satisfy many requirements if it is to be completely satisfactory in all respects. A workman employing means of this character is usually an installation man or a repairman and thus carries this flaring tool in a kit along with many other tools. It is essential, therefore, that the tool be capable of being packed efficiently and in a small space and should not have such construction that, though the actual tool is not excessively large, nevertheless it takes up considerable room in the kit or wastes space because of a lateral projection or the like. All parts of the tool including the clamping means should be as light as possible, consistent of course with necessary strength and proper functioning of the tool. During the day the workman will encounter tubes of a variety of sizes and, since it would not be practical to have a different tool for each size of tube, the clamping means should be capable of clamping a number of different sized tubes.

In the past, the "in line" tube clamping means, that is, means having apertures for clamping various sized tubes arranged in a longitudinal line, have proved most successful and popular. They have, however, had shortcomings which have not to date been successfully overcome. Such clamping means have consisted of parallel bars hinged at one end and drawn together at the other end after the tube to be clamped has been inserted therebetween. The result, of course, is a bending force and has either necessitated the bars being made extremely heavy or has required the formation of teeth in the recesses receiving the tubes. The result, of course, has been scoring and marking of the tubes which is undesirable from the appearance standpoint as well as from the mechanical standpoint, for frequently that scoring or marking has been enough to weaken the tubes.

It is among the more particular objects of the invention, therefore, to provide an "in line," multiple-tube-sized clamping means which does not score or mark the tubes and which is of light weight construction.

A further object is to provide an "in line," multiple-tube-sized clamping means in which the clamping thrust is a longitudinal force and thus one of tension or compression as distinguished from a lateral, and hence bending, force.

Still a further object is to provide tube clamping means composed of a carrier, a plurality of blocks recessed to form tube receiving bores and supported for movement longitudinally of the carrier, and means for applying to the blocks a longitudinal tube clamping force.

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Another object is to provide tube clamping means which is readily disassembled so as to permit removal of the blocks from the carrier for repair and subsequent replacement or substitution.

Another object is to provide a tube clamping means of the "in line," plural block and plural recess type in which the bores for the various sized tubes are so arranged as to permit the employment of blocks of uniform size, thus facilitating manufacture of the clamping means.

Yet another object is to provide tube clamping means in which extruded metal bars may be employed and first cut into blocks of uniform length and then drilled or otherwise formed to have recesses in opposed faces of the blocks.

Other objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a plan view partially in section of a preferred form of tube clamping means embodying my invention.

Fig. 2 is a side elevational view of the clamping means of Fig. 1.

Fig. 3 is a longitudinal sectional view taken approximately along the line 3—3 of Fig. 1 but with the clamping means rotated to open position, that is, 90° from the position shown in Fig. 1.

Fig. 4 is a fragmentary sectional view taken approximately along the line 4—4 of Fig. 1.

Fig. 5 is a plan view showing the carrier for the blocks spread to permit removal of the blocks.

Fig. 6 is a transverse sectional view taken approximately along the line 6—6 of Fig. 1.

Fig. 7 is a plan view similar to Fig. 1 showing a somewhat modified embodiment of my invention.

Fig. 8 is a side elevational view, again slightly in cross section, of the clamping means of Fig. 7.

Fig. 9 is a longitudinal sectional view showing the clamping means in unclamped position.

Fig. 10 is a sectional view taken approximately along the line 10—10 of Fig. 8.

Fig. 11 is a transverse sectional view taken approximately along the line 11—11 of Fig. 7.

Fig. 12 is an end elevational view of one element forming a part of the thrust applying means.

While the invention is susceptible of various modifications and alternative constructions, it is shown in the drawings and will hereinafter be described in a preferred embodiment and one modification. It is not intended, however, that the invention is to be limited thereby to the specific disclosures made. On the contrary it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as defined in the appended claims.

As shown in the drawings for purposes of disclosure, the tube clamping means comprises generally a carrier 15 of elongated form to permit of the "in line" arrangement of tube receiving bores or recesses, actual tube clamping or gripping means herein taking the form of a plurality of blocks 16, and means 17 for applying the longitudinal force, herein a thrust, for causing the blocks to perform their tube clamping function. In both forms of the invention, the carrier or support 15 and the blocks 16 are of identical construction and will, therefore, be described but once with like reference characters applied to corresponding parts in both forms of the invention. It is in the means 17 for applying the clamping force to the blocks that the two forms of the invention differ and these portions will, therefore, be separately described.

Turning now to a more specific description of the invention as herein disclosed, by way of exemplary embodiment, the carrier or support 15 takes the form of a narrow, very elongated U and is preferably formed from a long strip of steel. While the strip of steel is in a proper state, it is bent into the U-shape shown in the drawings and thus has a pair of legs 18 and 19 which normally are parallel with one another and a base or connecting yoke 20 forming the closed end of the U. For a purpose which will later become more apparent, the strip of steel, after it is bent into proper form, is heat treated to give the added hardness and, particularly, stiffness so that the legs 18 and 19 will be very resiliently held in parallel relationship. Inasmuch as the force to which the carrier 15 is subjected during the clamping of a tube is a longitudinal pull, the strip composing the carrier may be of relatively small cross sectional area and still provide the necessary strength to withstand any stress to which it is normally subjected. This, of course, is in contrast to the cross sectional area which the arms 18 and 19 would have to have were the force applied thereto a bending force. The length of the carrier 15 is determined primarily by considerations of convenience in handling by the workman, the necessity normally to provide clamping means for a given number of sizes of tubes only, and similar considerations. Unlike prior "in line" clamping means, increased length does not necessitate increased strength in the structure because of increased bending moment. Here the stress in the arms 18 and 19 is the same entirely independently of the length thereof.

The actual clamping of the tubes herein is effected not by the legs or arms 18 and 19 but by blocks 16 of which six are herein shown. This is, of course, an arbitrary number and might be increased or decreased without departing from the spirit and scope of the invention. Each block 16, as seen in Figs. 6 and 11, is generally rectangular in transverse section and is at each end formed with a channel 21 for the reception therein of legs 18 and 19. The blocks are slidable longitudinally of the carrier 15 and the width

of the channel 21 is for that purpose so dimensioned as to have a sliding but close fit on the edge faces of the legs 18 and 19. The depth of the channel 21, however, is made somewhat greater than necessary so as to provide a degree of play between the blocks and the legs 18 and 19. This play serves two purposes. The first of these is to permit both lateral shifting of the blocks and a degree of angular displacement of the blocks to make the blocks self-centering or self-aligning with respect to a tube being clamped. The other purpose or advantage is that dimensions need not be closely held and thus manufacture is facilitated.

Not only are the blocks 16 all of the same lateral dimension, but they are also all of the same dimension longitudinally of the carrier, which dimension will herein be termed width of the blocks. This uniformity in width of the blocks is made possible despite the variation in size of the bores in which the various sized tubes are clamped by a unique positioning and relative placement of the bores in the blocks. As clearly seen in Figs. 1, 3, 6, 7, 9 and 11, the bores receiving the various sized tubes are composed of semicylindrical and complementary recesses 22 formed in abutting faces of adjacent blocks. While the recesses 22 are generally referred to as semicylindrical, they are actually very slightly out-of-round with the transverse diametrical dimension of the resulting bore a few thousandths of an inch larger than the longitudinal diametrical dimension. This prevents scoring of the tube at the lines of juncture of the two recesses.

With the exception of the end blocks which, of course, have but one recess 22 formed therein, each of the intermediate blocks has a recess formed in each side face in order that the number of blocks required may be a minimum for the number of tube sizes capable of being clamped, more specifically, so that the number of blocks need be but one greater than the number of bores. This is made possible by an association of the recesses in inverse order of their relative sizes. Thus the second block from the left in Figs. 1 and 7 has formed therein the largest and the smallest recess. The third block has formed therein the remaining smallest recess and one of the second largest recesses. The fourth block has the remaining second largest recess and one of the second smallest recesses. This arrangement is continued regardless of the number of blocks, that is, number of different sized tubes that the means is adapted to clamp.

Among the many advantages of this construction are the economy and facility with which the clamping means, particularly the blocks, may be formed. The stock from which the blocks 16 are formed will initially take the form of a bar which will be extruded to have formed therein the channels 21 and which will otherwise be of the proper dimension. This bar will then be cut to form the blocks 16 and, since all of the blocks are the same width, this cutting of the bar into the blocks is readily done automatically and there need, moreover, be no readjustment or resetting to provide blocks of different width nor any checking to see that the required number of blocks of different widths are provided because there is but one width of block. Thus, to the point described, the only operation that has been performed is a simple cutting-off operation. The blocks may then be assembled either in the carrier 15 or in a suitable chucking device, the recesses 22 being formed therein in any manner such as by drilling,

broaching, or the like, and the recesses then being formed with a countersink 23 at one end, particularly if the clamping means is to be employed as part of a flaring tool. It will be readily apparent, of course, that several tiers of blocks could be chucked up and the recesses formed in all at one time so as to reduce the cost of production. It will be understood, of course, that the clamping means is assembled simply by slipping the blocks 16 into the holder 15 through the open end thereof before the clamping force exerting or generating means 17 is incorporated.

Turning now specifically to the form of the invention shown in Figs. 1 to 6, the clamping force generating means 17 takes the form of a screw device pivotally mounted to be swung to a position longitudinally of the carrier 15 for applying the clamping force and to a position transversely of the carrier 15 to permit a separation of the blocks for the reception or withdrawal of a tube. Herein the screw device comprises a T-shaped body member 26. The cross bar portion 27 of the body member is formed at its ends with slightly reduced portions 28 forming trunnions received in apertures 29 formed in the free ends of the legs 18 and 19. The stem portion 30 of the T-shaped body member 26 is tubular and is internally threaded to receive a bolt 31 having rigid therewith at its outer end a wing nut 32. The inner end of the bolt is preferably rounded and the block engaged by the end of the bolt 31 preferably has a dimple 33 formed therein for engagement by the end of the bolt 31. To facilitate use of the clamping means by a workman, means is provided for arresting the screw device in longitudinal position as it is swung toward that position preparatory to applying a tube clamping force through turning of the bolt 31. To that end, a portion of the face of the end block 16 adjacent the screw device is cut away as at 34 to form a lip or shoulder 35 which the end of the stem portion 30 strikes.

The construction and the steps in the method of making the clamping means are believed fully understandable from the foregoing description. While use of the clamping means will be readily apparent to any one skilled in the art, a brief statement concerning the manner of use may not be amiss. To clamp a piece of tube, the workman first gives the bolt 31 a few turns to disengage it from the dimple 33 and then swings the screw device laterally to the position shown in Fig. 3. He next separates the blocks 16 at a point depending upon the size of the tube that is to be clamped (as in Fig. 3) and then inserts the tube between the separated blocks by relative movement of the tube and the clamping means axially of the tube. Having inserted the tube, the screw device is swung to its operative or longitudinal position. As an incident to such swinging, the screw device acts as a cam forcing the separated blocks together into some gripping relationship to the tube. The workman need not exercise any special care in centering the tube for, because of the play provided by the clearance between the channels 21 and the arms 18 and 19, the blocks are self-centering and will automatically grip the tube in proper centered relationship. When the screw device is in its operative or longitudinal position, as shown in Figs. 1 and 2, the workman next turns the bolt 31 to apply the necessary final gripping pressure to the blocks. It will be readily apparent, of course, that a very great pressure can be applied if necessary and that for that reason the recesses 22 need not be formed with

teeth, serrations or other means to aid in holding the tube against axial displacement, which means, of course, always score the tube. The workman then performs the desired operation on the tube, such as flaring the end thereof, by applying a conventional flaring tool yoke to the clamping means and then again gives the bolt 31 a few turns to withdraw it from the dimple 33, swings the screw device to the position of Fig. 3 and separates the blocks clamping the tube, and withdraws the tube. Thus it will be seen that the clamping means lends itself to very convenient manipulation by the workman, while at the same time securely holding the tube without scoring or marring and while yet of very light construction.

The clamping means herein disclosed also lends itself to the substitution of different sets of blocks adapting a single carrier 15 and clamping pressure generating means for the clamping of a great variety of tubes. This means, of course, that a workman need invest a smaller amount of money in tools and need also be burdened with a smaller weight of tools to carry around. The initial assembly of the blocks in the carrier 15 or any subsequent removal and substitution of blocks is readily effected simply by spreading the carrier 15, as shown in Fig. 5, removing the screw device and sliding the blocks out through the open end of the carrier. Because of the resilient character of the carrier 15 and because there is no lateral force generated in a clamping operation which tends to separate the legs or arms 18 and 19, the screw device may be retained simply by insertion of the trunnions in the apertures 29 without necessity of any additional retaining means.

Turning now to the form of the invention shown in Figs. 7 to 12, as above stated, this form of the invention is identical with that disclosed in Figs. 1 to 6 save for the construction of the means for applying the gripping or clamping force. Accordingly, like reference characters have been applied to all of the elements that are identical with the first form and the description of the first form will, and is intended to, apply to this form.

The gripping force generating means in this form is in the nature of a cam lever adapted to be pivotally mounted in the carrier 15 at the open end thereof for swinging movement in a plane passing through the longitudinal axis of the clamping means to an open or inoperative position wherein the blocks 16 may be separated for the insertion or removal of a tube and to an operative or clamping position in which the blocks are forced into gripping relation to a tube. The lever is composed of a tubular socket portion 40 and a bifurcated portion 41, the bifurcations having considerable width at their ends. The socket portion 40 is intended removably to receive an actuating bar or rod, for example, the same bar that is used in rotating the flaring-cone-carrying bolt in a flaring tool. The cam lever is pivotally mounted on a bolt 42 passing through the bifurcations near one outer corner thereof. In the remaining outer corner but interposed between the bifurcations is a roller 43 rotatably mounted on a rivet 44. This roller 43 projects out of the bifurcations so as to engage the end block 16 as the lever is swung to operative position, thereby to reduce the frictional resistance to such movement of the lever. The roller 43 also is positioned with its axis slightly below the axis of the bolt 42, as viewed in Fig. 8,

so that the lever in final operative position has an over-center position assuring its remaining in that position during operation on the tube that has been gripped. As best seen in Fig. 8, the tubular portion 40 also strikes the rightmost block 16 when the lever is in operative position, thereby holding the lever in its slightly over-center position.

In order that the clamping force exerted by the lever may be adjusted and, particularly, so that any wear that may take place may be taken up, means is provided for adjusting the lever relative to the carrier 15. To that end, the bifurcations 41 are not mounted directly on the bolt 42 but interposed between the bolt and the bifurcations is a sleeve 45. This sleeve has a cylindrical, external surface and is received in truly circular apertures 46 formed in the bifurcations 41. The sleeve is, however, provided with a slightly eccentric bore 47 in which the bolt 42 is received. Thus by rotation of the sleeve 45 the lever will be adjusted longitudinally of the carrier 15 because of the eccentricity of the bore in the sleeve. To facilitate adjustment of the sleeve, it is formed with a plurality of radial recesses 48 intermediate the ends thereof so as to be accessible through the space between the bifurcations. Any pointed instrument may be inserted into one of the recesses and the sleeve given the desired degree of rotation. Thereafter the bolt 42 which passes loosely through the leg 19 of the carrier 15 and is threaded into the leg 18 of the carrier is rotated to clamp the sleeve 45 tightly between the two legs. The sleeve 45 is for this purpose made slightly longer than the thickness of the lever and has its ends knurled or serrated, as shown in Fig. 12.

The steps involved in use of this form of clamping means are generally the same as those involved in using the first form save that fewer movements on the part of the workman are required. Thus, to grip a piece of tube the workman first swings the lever to the position shown in Fig. 9, then separates the blocks at the desired point depending upon the size of the tube to be gripped, inserts the tube, and then swings the lever toward operative or gripping position ending with the lever in the position shown in Figs. 7 and 8. It will be appreciated that initially the end edge 49 of the bifurcations 41 will engage and cam the block 16 into gripping engagement with the tube. Once the initial gripping of the tube has taken place, the roller 43 engages the end block 16 to apply the final gripping force as the lever moves to its beyond dead center position, shown in Figs. 7 and 8. By this simple movement, the tube is clamped and by an equally simple movement, that of again swinging the lever to the position shown in Fig. 9, the tube is released. A further advantage is that in this form the gripping pressure applied to a tube is the same and does not depend upon the strength or the practice of the workman, as is the case where the degree of tightening of a screw device is dependent upon the strength of the workman, or his zeal or lack of ambition.

I claim as my invention:

1. A tube clamping means for a tube working tool comprising, in combination, an elongated carrier with means at one end having a generally semi-cylindrical recess formed therein extending perpendicular to the general plane of said carrier, at least three blocks mounted on said carrier for sliding movement longitudinally thereof, each adjacent side face perpendicular to the general plane of said carrier of each of the intermediate blocks and the inwardly facing side face of the end block also having a generally semi-cylindrical recess formed therein extending perpendicular to the general plane of said carrier, said adjacent faces of said blocks and of the end means of said carrier having complementary recesses with the recesses in any one block of different size and with one of the largest and one of the smallest recesses in one block and the remaining smallest and one of the next largest in the adjacent block, and means at the remaining end of said carrier operable to provide longitudinal force urging said blocks to tube gripping position.

2. A claim according to claim 1 in which the carrier is U-shaped with a pair of legs each having a bearing aperture near its free end, said legs being resiliently biased inwardly and in the free state converging toward one another, and in which the last named means of claim 1 includes a shaft-like member reduced in diameter at each end to form a trunnion rotatably receivable in the aperture in a leg and a shoulder limiting projection of the trunnion into the aperture whereby said last named means is resiliently held between the legs and the legs are held in parallel relationship.

3. A tube clamping means for a tube working tool comprising, in combination, an elongated U-shaped carrier with a pair of legs each having a bearing aperture near its free end, said legs being resiliently biased inwardly and in the free state converging toward one another, at least four blocks loosely mounted in said carrier for sliding movement longitudinally thereof, each adjacent side face perpendicular to the general plane of said carrier of each of the intermediate blocks and the inwardly facing side face of each end block having a generally semi-cylindrical recess formed therein extending perpendicular to the general plane of said carrier, said adjacent faces of said blocks having complementary recesses with the recesses in any one block of different size, one of the end blocks having one of the largest recesses, the adjacent block having a complementary recess and one of the smallest recesses and the next block having the remaining smallest and one of the next largest recesses, and means closing the open end of said carrier operable to provide longitudinal force applied on a line passing through the centers of said recesses urging said blocks to tube gripping position, said means being resiliently held journaled in the bearing apertures in said legs to be swingable to an inoperative position to permit spreading of the blocks for the insertion of a tube and to permit total removal of said means, for subsequent removal of said blocks, by spreading of said legs.

4. A tube clamping means for a tube working tool comprising, in combination, an elongated carrier open at one end, not less than five blocks of uniform size mounted on said carrier for sliding movement longitudinally thereof, each adjacent side face perpendicular to the general plane of said carrier of each of the intermediate blocks and the inwardly facing side face of each end block having a generally semi-cylindrical recess formed therein extending perpendicular to the general plane of said carrier, said adjacent faces of said blocks having complementary recesses with the recesses in any one block of different size, one of the end blocks having one of the largest recesses, the adjacent block having a com-

plementary recess and one of the smallest recesses and successive intermediate blocks having a complementary recess and alternatively one of the next largest and one of the next smallest recesses, and means closing the open end of said carrier operable to provide longitudinal force applied on a line passing through the centers of said recesses urging said blocks to tube gripping position.

GEORGE E. FRANCK.

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