June 7, 1938. A. M. SMITH 2,120,118

MANUFACTURE OF CLEVISES AND THE LIKE

Filed Dec. 5, 1934



FIG. 1

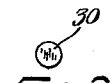


FIG. 2

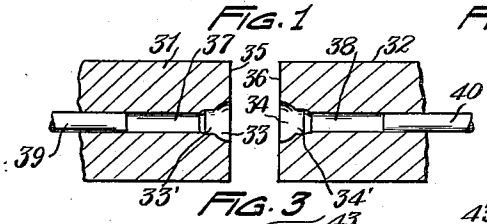


FIG. 3

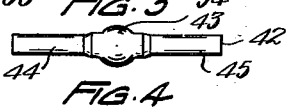


FIG. 4



FIG. 5

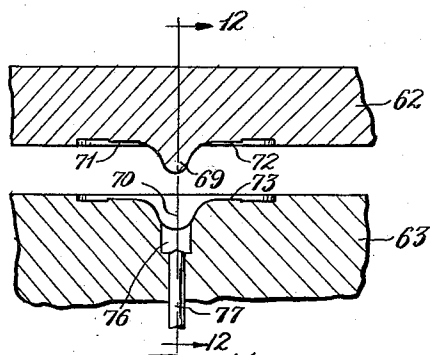


FIG. 11

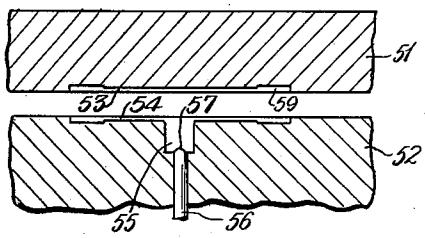


FIG. 6

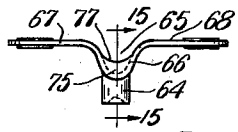


FIG. 13

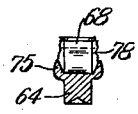


FIG. 15

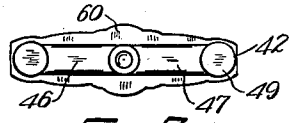


FIG. 7

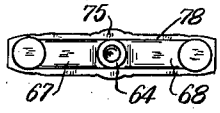


FIG. 14

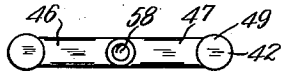


FIG. 8

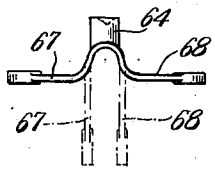


FIG. 16

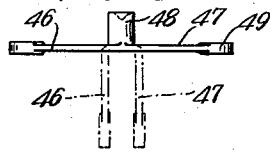


FIG. 9

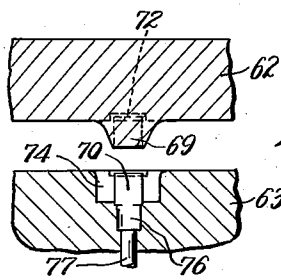


FIG. 12

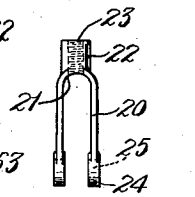


FIG. 18

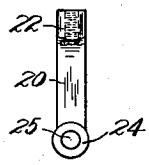


FIG. 17

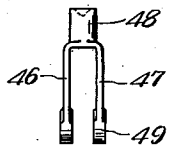


FIG. 10

INVENTOR.
ALEXANDER M. SMITH

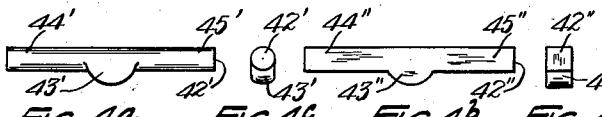


FIG. 4a FIG. 4c FIG. 4b FIG. 4d

BY Kuis Hudson & Kent
ATTORNEYS

Patented June 7, 1938

2,120,118

UNITED STATES PATENT OFFICE

2,120,118

MANUFACTURE OF CLEVISES AND THE LIKE

Alexander M. Smith, Kent, Ohio, assignor to The Lamson & Sessions Company, Cleveland, Ohio, a corporation of Ohio

Application December 5, 1934, Serial No. 756,096

9 Claims. (Cl. 29—152)

This invention relates to a novel method for the manufacture of yoke-like metal articles, such as clevises and the like, whereby articles of this kind having uniformity and accuracy can be rapidly and cheaply produced.

An object of the invention is to provide a novel method of making clevises or the like, in accordance with which a length of stock is shaped to have an increased body of metal intermediate its ends, and thereafter the end portions of the blank are bent into adjacent relation with each other to form the arms of the article.

Another object of the invention is to provide a novel method of producing clevises or the like, in accordance with which the intermediate portion of a length of stock is enlarged relative to its end portions, and thereafter the enlarged portion is formed into a boss and the end portions of the blank are bent into adjacent relation with each other.

Another object of the invention is to provide a novel method of making clevises wherein an intermediate portion of a length of stock is enlarged, and thereafter the blank is flattened at opposite sides of the enlargement and in the same operation the enlargement is formed into a boss or shank, and wherein the flattened portions are subsequently bent toward each other.

A further object of the invention is to provide a novel method of making clevises wherein a blank is provided with an intermediate enlarged portion and such intermediate portion is shaped to form a boss extending substantially normally to the axis of the blank, and wherein end portions of the blank are thereafter bent toward each other.

Yet another object of the invention is to provide a novel method of making clevises, or the like, which includes the steps of enlarging an intermediate portion of a length of stock and then displacing metal of the enlarged portion transversely of the blank to form a recess in one side of the blank and a boss on the other side substantially in line with the recess, and thereafter bending end portions of the blank toward each other.

Another object of the invention is to provide a novel method of making clevises or the like, wherein an intermediate portion of a length of stock is enlarged relative to its end portions by an upsetting, swaging or extruding step or a combination of such steps, and wherein at least a part of the metal of such enlarged portion is shaped into a boss and end portions of the blank are bent into adjacent relation to each other.

Other objects and advantages of the invention will be apparent from the following description when taken in conjunction with the accompanying sheet of drawings, wherein

Fig. 1 is an elevational view showing a length of bar stock which may be used in carrying out my method.

Fig. 2 is an end view thereof.

Fig. 3 is a sectional view showing cooperating die members which may be used in carrying out the first forming step or operation of my method.

Fig. 4 is an elevational view of the blank resulting from the first forming operation.

Figs. 4^a and 4^b are side elevations of other shapes for the blank having the enlarged intermediate portion.

Figs. 4^c and 4^d are end views, respectively, of the blanks shown in Figs. 4^a and 4^b.

Fig. 5 is an end view of the blank of Fig. 4.

Fig. 6 is a sectional elevation showing cooperating die members which may be used for carrying out the second forming step of my method.

Fig. 7 is a plan view of the blank resulting from the second forming step.

Fig. 8 is a plan view of the same blank after having been trimmed.

Fig. 9 is an edge view of the same blank.

Fig. 10 is an edge view of the blank after the end portions thereof have been bent to form the yoke arms.

Fig. 11 is a sectional view of cooperating die members, of modified form, which may be used in carrying out the second forming step of my method.

Fig. 12 is a transverse sectional view taken on line 12—12 of Fig. 11.

Fig. 13 is an edge view of the blank produced by the dies of Figs. 11 and 12.

Fig. 14 is a plan view of the same blank.

Fig. 15 is a transverse sectional view of the blank taken on line 15—15 of Fig. 13.

Fig. 16 is an edge view of the same blank after having been trimmed.

Fig. 17 is a side elevation of a clevis produced by my method, and

Fig. 18 is an edge view thereof.

In the accompanying drawing to which detailed reference will now be made, I have illustrated the formation of a clevis, or like metal article, by the novel method and apparatus of my invention. It should be understood, however, that the accompanying drawing is illustrative only, and that the invention may be carried out in various ways and by the use of various mechanical apparatus.

Before proceeding with the detailed explanation, I shall describe briefly one of the yoke-like metal articles or clevises to the production of which my method and apparatus are adapted. One of these articles is illustrated in Figs. 17 and 18 of the drawing, but it will be understood, of course, that my novel method and apparatus may be used for producing a great variety of metal articles of this general character.

As shown in the drawing, Figs. 17 and 18, the metal article which, for convenience, is referred to as a clevis, is provided with a pair of substantially parallel yoke arms **20** which are integrally connected together at one end by a transverse arch-like connecting part **21**. The clevis is also provided adjacent the connecting part **21** with an integral boss or shank **22** which extends in substantial alignment with the arms **20**. The boss **22** may be provided with a threaded opening **23** for connection of the clevis with a threaded rod or other power transmitting member. The arms **20** may be provided at their outer ends with flat enlargements or bosses **24** having aligned openings **25** therethrough adapted to receive a pivot pin or the like.

In accordance with my novel method, as will be explained more in detail hereinafter, the clevis is formed from a single piece of suitable metal stock, such as a length of solid bar stock which may be of round or other cross section. In carrying out the method the length of stock is provided with an enlargement at a point intermediate its ends, and then by a forming operation the blank is shaped so that at least a portion of the metal of the enlargement forms the boss or shank of the clevis. Thereafter end portions of the blank are bent toward each other to form the arms of the clevis.

In Figs. 1 and 2 of the drawing I have shown a length of stock **30**, such as that mentioned above, and from which the clevis may be formed. The length of stock, which is here shown of round cross section, may be obtained by cutting wire or other solid bar stock of proper size to the length necessary to provide the requisite amount of metal to produce the article.

In carrying out the first forming operation of my novel method, the length of stock is acted upon to provide the same with an enlargement at a point intermediate its ends. The forming of this enlargement may be carried out as an upsetting, swaging or extruding step, or by any combination of such steps. In Fig. 3 of the drawing, I have shown cooperating die members **31** and **32** which are adapted to act on a length of stock for the first forming operation.

These die members may be provided with complemental recesses **33** and **34** in their adjacent faces **35** and **36**, and are also provided with substantially aligned elongated recesses or bores **37** and **38** communicating with and extending away from the complemental recesses. The recesses **33** and **34** are of a size and shape to provide a volume corresponding with the volume desired for the enlargement to be formed on the intermediate part of the stock, and the bores **37** and **38** are of the size and shape which the end portions of the blank are to have after the first forming operation. The recesses **33** and **34** may have short extensions **33'** and **34'** which connect the recesses with the respective bores **37** and **38**. These extensions **33'** and **34'** are preferably of a cross sectional shape and size to just receive the ends of the length of stock **30**. The bores **37** and **38** are preferably of a smaller size than the extensions **33'** and **34'** so that the metal of the stock must be forced or extruded into the bores. Knock-out pins **39** and **40** may be arranged in the bores **37** and **38** to form the outer end walls thereof and to be used in ejecting the work from the dies after the enlarging operation.

In carrying out the method the length of stock **30**, which has been cut to provide the requisite amount of metal for producing the clevis, is received between the die members and its ends engage in the extensions **33'** and **34'** of the die recesses. By bringing the die members toward each other the length of stock is subjected to endwise pressure which causes a shortening of the stock and enlarging of its intermediate portion relative to its end portions. The endwise pressure on the stock causes the intermediate portion of the length to be upset and thereby enlarged. This pressure also causes metal of the stock to be forced or extruded into the bores **37** and **38** but as the latter are of smaller cross section than the original length of stock **30** they will be able to accommodate only a part of the metal of the stock and the excess will remain at, and furthermore enlarge, the intermediate part of the length of stock. As the die members **31** and **32** approach each other, the increased body of metal at the intermediate part of the stock is squeezed and shaped by the complemental recesses **33** and **34**.

In Fig. 4 of the drawing I have shown a blank **42** which is the result of the forming action of the die members **31** and **32**. This blank has an enlarged bulbous intermediate portion **43** which has been produced by shaping action of the complemental recesses **33** and **34**. The end portions **44** and **45** of the blank, which have been formed by the forcing or extruding of metal into the bores **37** and **38** as explained above, are of smaller cross section than the end portions of the original stock but are, however, large enough to form the arm portions of the article as explained hereinafter.

The complemental recesses **33** and **34** of the die members and the bulbous enlargement **43** of the blank are here shown as being round and symmetrical with respect to the axis of the stock. This is not necessary to the invenion and, if desired, the recesses **33** and **34** may be otherwise shaped, as for example, to form a bulbous enlargement of the shape represented in Fig. 4ª wherein corresponding parts of the blank are designated by primed reference characters.

When the first forming operation of my method is carried out with the die members **31** and **32**, as above explained, the enlarging of the intermediate portion of the blank is accomplished as a combined upsetting and extruding operation. If desired however, the enlarging may be done entirely as an upsetting operation. In the accomplishment of this end, the bores **37** and **38** of the die members **31** and **32** would be of a cross sectional size and shape to just receive the ends of the length of stock.

The first forming operation may also be carried out as a swaging operation which produces either of the blanks **42** and **42'**. During such a swaging operation, cooperating dies of well known type would act on a length of stock, which in cross section is substantially the size of the bulbous enlargement, and would displace metal in the direction of the axis of the stock and away from the intermediate part thereof. This reduces the end portions of the stock leaving the intermediate part thereof relatively enlarged.

Although the first forming operation of my

method is preferably carried out by a pressure shaping operation in which metal of the stock is caused to flow, as above explained, the blank with the relatively enlarged intermediate part may be produced in other ways. For example, the blank may be sheared from plate stock and, in Fig. 4b of the drawing, I have shown such a sheared blank.

The blank 42, or a blank 42' or 42'' as the case may be, is next subjected to a forming operation by which the end portions 44 and 45 of the blank are flattened and shaped to arm-like extensions 46 and 47 shown in Figs. 7, 8 and 9. The intermediate bulbous portion 43 is, preferably in the same operation, also shaped so that at least a portion of the metal of this enlargement forms a boss 48 projecting from one side of the blank substantially normal to the axis thereof. During the flattening of the ends of the blank to form the arm portions 46 and 47, the metal may also be shaped to provide the flat bosses 49 through which the openings 25 are subsequently formed for the pivot pin.

In carrying out this second forming operation cooperating die members 51 and 52, as illustrated in Fig. 6, may be used. These die members are provided with elongated complemental recesses 53 and 54 which act upon the end portions 44 and 45 of the blank 42 to cause the flattening and shaping of these portions of the blank into the corresponding arm portions 46 and 47 shown in Figs. 7, 8 and 9. The lower die member 52 is provided with a cylindrical pocket or recess 55 the upper end of which communicates with the recess 54 at an intermediate point of the latter recess. The bottom wall of the recess 55 may be formed in part by an ejector pin 56 by means of which the blank may be ejected from the die member 52 after the forming operation. The upper end of this ejector pin may be provided with a conical point 57 which extends into the recess 55 to form a centering depression 58 in the blank during the forming operation. The complemental recesses 53 and 54 may be provided at the ends thereof with enlargements 59 which are of a size and shape to form the flat bosses 49 at the ends of the arm-like projections 46 and 47.

In carrying out the second forming operation, the blank 42 of Fig. 4 is subjected to pressure between the die members 51 and 52 whereby at least some of the metal of the enlargement 43 is displaced transversely of the blank and forced into the recess 55 to form the shank or boss 48. During the same operation the end portions 44 and 45 of the blank are squeezed between the die members 51 and 52 and thereby flattened and shaped by the complemental recesses 53 and 54 to the shape illustrated in Figs. 7, 8 and 9 for the projecting arm portions 46 and 47. The recesses of the cooperating die members 51 and 52 are preferably so formed, and the volume of metal provided in the blank 42 is preferably such, that it is not necessary to bring the die members into actual meeting relation, but need be brought together only close enough to force the metal into the recesses thereof and to cause the arm portions 46 and 47 to have the proper thickness. In bringing the die members toward each other any excess metal contained in the blank is squeezed out laterally between the die members in the form of fins or flash metal 60, shown in Fig. 7.

After the blank has been subjected to this second forming operation between the die members 51 and 52 the die is opened and the blank is ejected from the die 52 by the pin 56. The blank resulting from this forming operation has the shape shown in Fig. 7 and is then subjected to a trimming operation for the removal of the flash 60. This trimming operation may be performed by the use of any well known apparatus and after being performed the resulting blank has the shape illustrated in Figs. 8 and 9.

The next operation to be performed upon the blank is that of bending the projecting arm portions 46 and 47 into the substantially parallel spaced relation represented by the arms 20 of the clevis shown in Figs. 17 and 18. This bending operation may be performed by the use of any suitable apparatus and consists simply in the bending of the arm portions toward each other and away from the boss 48, as indicated by the dotted lines of Fig. 9. After the bending operation has been performed the arm portions 46 and 47 extend away from the boss 48 and in substantial alignment therewith, as shown in Fig. 10, and the blank is then ready to have the tapped opening 23 formed in the boss 48 and the aligned openings 25 drilled or otherwise formed in the flat bosses 49 of the arm portions.

Another and somewhat different way of carrying out the second forming operation of my novel method may be employed, during which use may be made of a modified form of cooperating die members 62 and 63 shown in Figs. 11 and 12. In accordance with this modified forming operation, a portion of the enlargement 43 of the blank 42 is displaced transversely of the blank to form a boss or shank 64, as shown in Figs. 13, 14 and 15, and to also form a recess 65 in the opposite side of the blank substantially in line with the boss 64. In forming this recess in one side of the blank the portions 66 of the arms 67 and 68 of the blank are shaped to substantially the rounded form desired for the transverse connecting part or arch in the finished article at this point.

For forming the recess 65 in the blank and causing the corresponding transverse displacement of metal of the enlargement 43, I provide the die members 62 and 63, respectively, with a projection 69 and a recess 70. The projection 69 is a tapering rounded tongue of metal, as shown in Figs. 11 and 12, which may be of a length corresponding with the extent to which it is desired to draw or displace the metal of the intermediate portion of the blank. This projection has an effective width approximately equal to the width of the recesses 71 and 72 of the die member 62 which forms the arm portions 67 and 68 of the blank.

The die member 63 is provided with an elongated shallow recess 73 the ends of which are complemental to the recesses 71 and 72 of the die 62, and the center of which communicates with the recess 70. The latter recess is of rounded shape, corresponding with the shape of the projection 69, and is also of an effective width approximately equal to the width of the shallow recess 73. Relief spaces 74 may be formed in the die member 63 as side extensions of the recess 70 to accommodate excess metal which is squeezed out as the flash webs 75 indicated in Figs. 14 and 15. The die member 63 is also provided with a cylindrical recess or pocket 76 having a transverse dimension which is preferably slightly less than the corresponding width or transverse dimension of the recess 70. The cylindrical recess 76 communicates at its upper end with the recess

70 and is, in effect, a continuation or extension of the latter recess. The bottom wall of the recess 76 may be formed in part by the centering pin 77 which also serves to eject the work from the die member 63 after the forming operation has been performed.

In carrying out this modified second forming operation the blank 42 of Fig. 3 is subjected to pressure between the die members 62 and 63 whereby metal from the enlargement 43 is forced downwardly into the recesses 70 and 76 by the projection 69 and the end portions 44 and 45 of the blank are flattened and shaped by the complemental recesses 71, 72 and 73 of the die members. In addition to forcing metal of the enlargement into the recesses 70 and 76, the projection 69 also forms the recess 65 in one surface of the blank and shapes the portions 66 which connect the arms 67 and 68 with the boss 64. During this operation any excess metal of the blank is squeezed laterally outwardly between the die members 62 and 63 beyond the edges of complemental recesses 71, 72 and 73 as the flash 78 indicated in Fig. 14, and outwardly into the relief spaces 74 as the flash webs 75 shown in Figs. 14 and 15.

After the forming operation is completed the die members 62 and 63 are separated and the blank is ejected from the die member 63 by the pin 77. The blank now has the shape illustrated in Figs. 13, 14 and 15. By the use of any suitable apparatus the flashes 75 and 78 are now trimmed from the blank. After the trimming operation the blank is of the form and shape illustrated in Fig. 16, from which it will be noted that the connecting portions 66 of the arms already extend in approximate alignment with the boss 64.

The blank is next subjected to a bending operation whereby the arm portions 67 and 68 are bent toward each other and into substantial parallel relation, as indicated by the dotted lines of Fig. 16. After this bending operation has been performed, the arms of the blank extend away from and in alignment with the boss 64 and the blank then has the shape represented in Fig. 10 and is ready for the tapping and drilling of the openings 23 and 25, mentioned above.

In the performance of my method any or all of the steps may be carried out with the metal of the stock in a heated condition but, if desired, any or all of the steps may be carried out with a cold working of the metal. Also, if desired, the metal may be heat treated before any of the various steps.

It will be understood, of course, that a punch press or other suitable well known apparatus may be used for operating the dies of Figs. 3, 6, 11 and 12.

From the foregoing description and accompanying drawing it will now be readily understood that I have provided a novel method and apparatus for the production of clevises, and like articles, by subjecting a piece of stock to successive forming operations. It will be understood further that one of these forming operations consists in relatively enlarging an intermediate portion of a length of stock as by upsetting, extruding, swaging or shearing of the metal, or any combination of these actions, and another of the forming operations consists in shaping the enlarged intermediate portion so that at least a portion of the metal thereof forms the boss or shank of the clevis.

While I have illustrated and described the method and apparatus of my invention in a somewhat detailed manner, it should be understood however that I do not wish to be limited to the exact details of construction and steps of procedure above explained, but regard my invention as including such changes and modifications as do not involve a departure from the spirit of the invention and the appended claims.

Having thus described my invention, I claim:

1. The method of making a clevis or the like which comprises applying endwise pressure to a length of solid bar stock and thereby extruding opposite ends of the stock into die openings of smaller cross-section than the stock whereby metal is displaced from said ends to provide the stock with an increased body of metal at an intermediate point, pressure shaping said body of metal whereby at least a portion of the metal thereof forms a boss, and then bending extending portions of the blank toward each other.

2. The method of making a clevis or the like which comprises enlarging a length of solid bar stock at a point intermediate its ends by forcing opposite ends of such length into die openings of relatively smaller cross-section while the intermediate part of the length is initially unconfined, displacing metal of the enlarged portion transversely of the blank and thereby forming a recess in one side of the blank and a boss on the other side substantially in line with the recess, and then bending end portions of the blank into adjacent relation with each other.

3. In a method of making clevises or the like the steps of enlarging a length of solid bar stock at a point intermediate its ends by forcing opposite ends of such length into die openings of relatively smaller cross-section while the intermediate part of the length is initially unconfined, flattening the blank at opposite sides of the enlargement and displacing metal of the enlargement transversely to form a recess in one side of the blank and a boss on the other side substantially in line with the recess, and then bending the flattened portions toward each other.

4. A blank for making a clevis or the like comprising an elongated solid metal body having a bulbous enlargement intermediate its ends and substantially symmetrically disposed with respect to the axis of the body, the ends of the body extending oppositely from said enlargement being of substantially uniform cross-section throughout their length.

5. In a method of making metal articles of the character described, the step of applying endwise pressure to a length of solid bar stock and thereby extruding opposite ends of the stock into die openings of smaller cross-section than the original stock while an intermediate portion of the length of stock is initially unconfined and, in the same operation, upsetting said intermediate portion of the stock.

6. In a method of making metal articles of the character described, the step of upsetting a length of solid bar stock at an intermediate point thereof by axially extruding opposite ends of the stock into die openings of relatively smaller cross-section than the original stock.

7. In a method of making metal articles of the character described, the step of upsetting a length of solid bar stock at an intermediate point thereof by axially extruding opposite ends of the stock into die openings of relatively smaller cross-section than the original stock and in the same operation pressure shaping the upset portion of the stock.

8. The method of making clevises or the like

which comprises applying axial pressure at opposite ends of a length of solid bar stock and thereby extruding opposite ends of the stock into die openings of smaller cross-section than the original stock whereby metal is displaced from said ends to provide the stock with an upset portion intermediate its ends and in the same operation pressure shaping the upset portion into a bulbous enlargement, pressure forming said enlargement and thereby shaping at least a portion of the metal thereof into a boss, and then bending end portions of the blank toward each other.

9. The method of making a clevis or the like which comprises applying axial pressure to opposite ends of the length of stock to cause extruding of said ends into die openings of smaller cross-section than the original stock and thereby enlarging an intermediate portion of the stock relative to its ends by displacing metal from said ends into said intermediate portion, pressure shaping said enlarged portion to thereby form a boss extending substantially normal to the axis of the blank, and then bending end portions of the blank away from the boss and into adjacent relation with each other.

ALEXANDER M. SMITH.