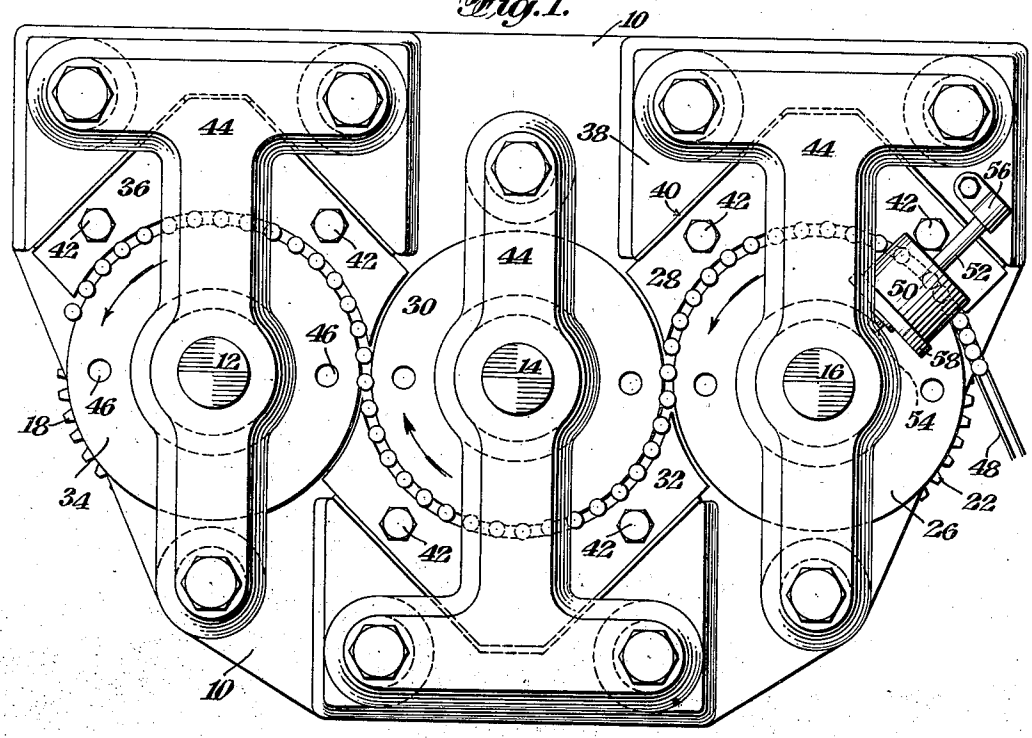
Nov. 21, 1939. H. E. SIPE 2,180,555

MACHINE AND METHOD FOR ROLLING RIVETS

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Fig. 1.



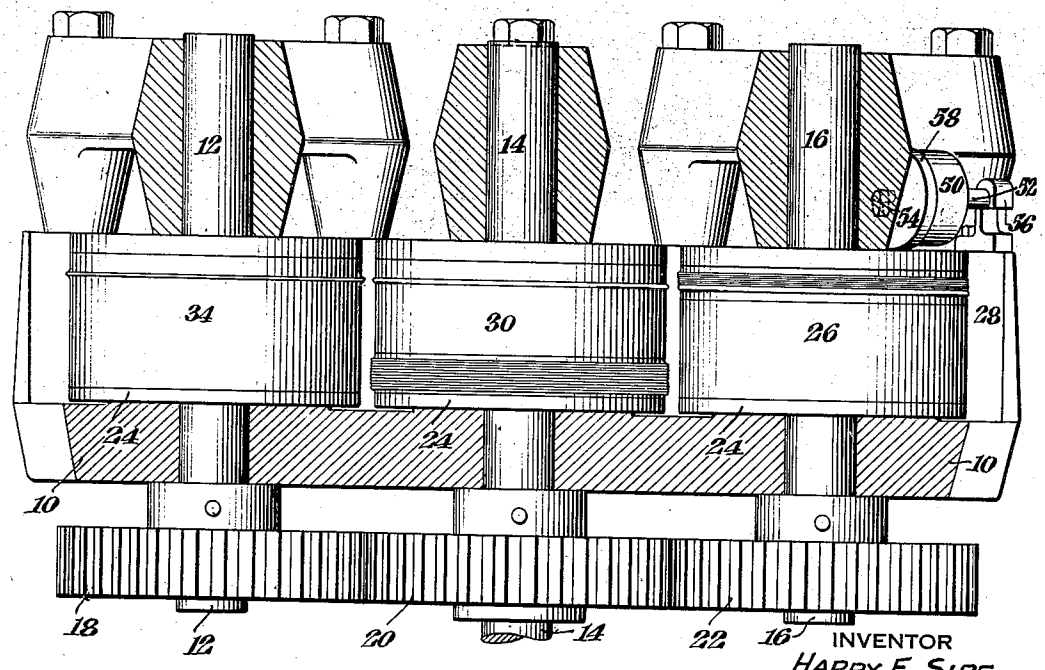


Fig. 2.

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MACHINE AND METHOD FOR ROLLING RIVETS

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Fig. 5.

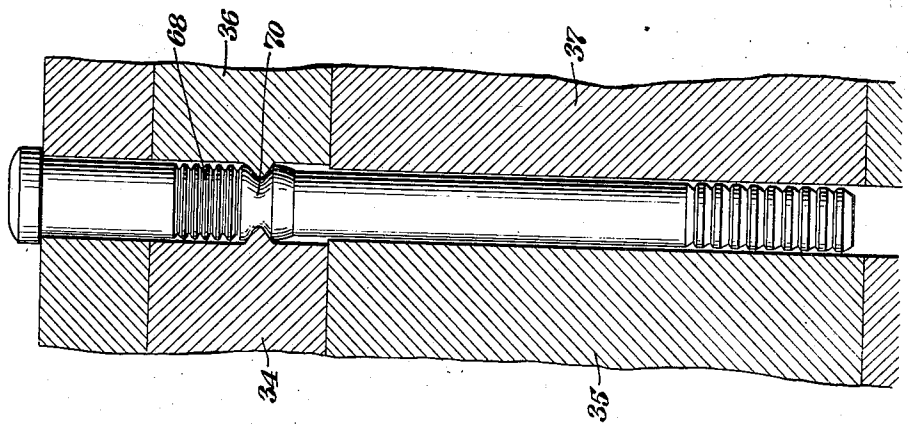


Fig. 4.

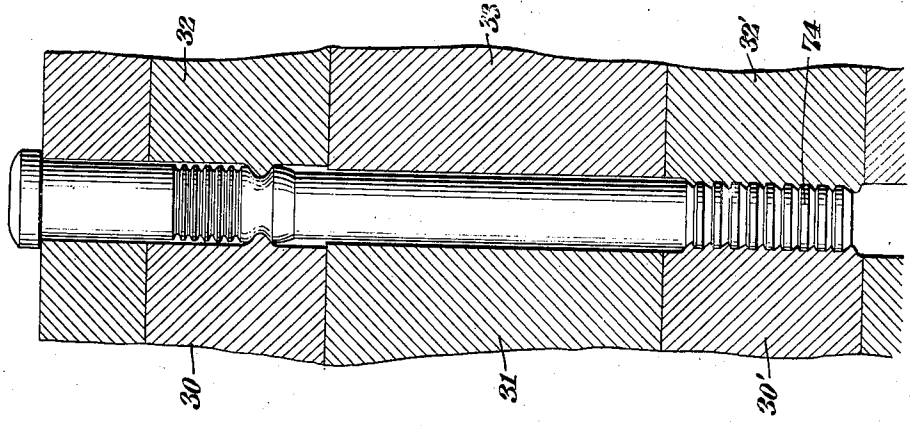
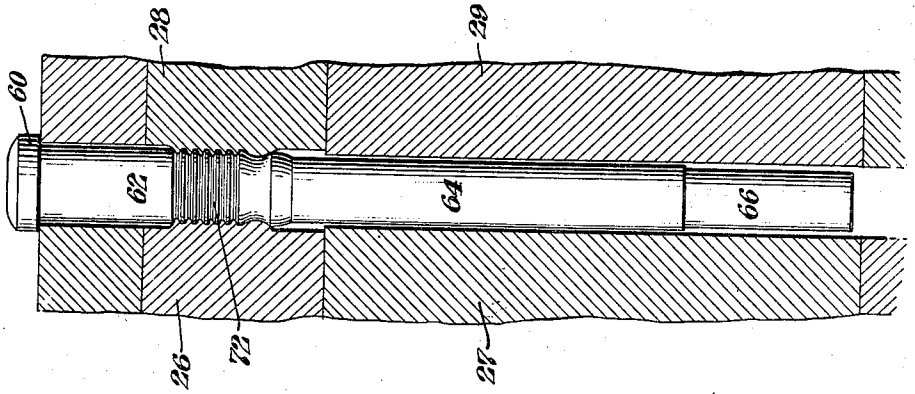


Fig. 3.



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MACHINE AND METHOD FOR ROLLING RIVETS

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Fig. 6.

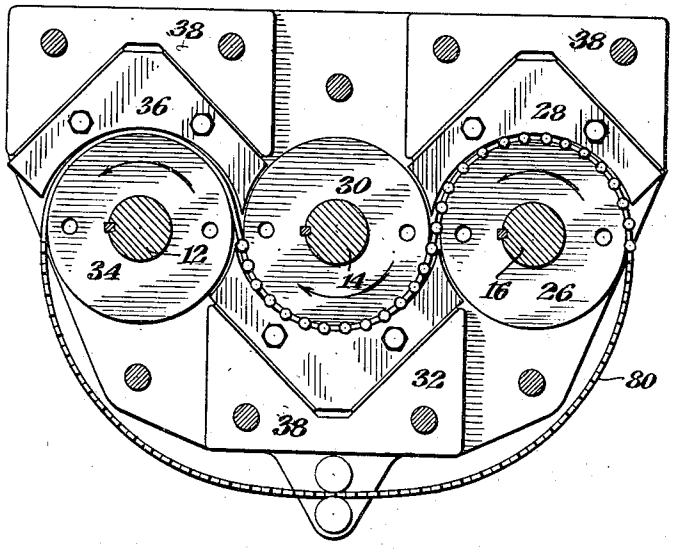
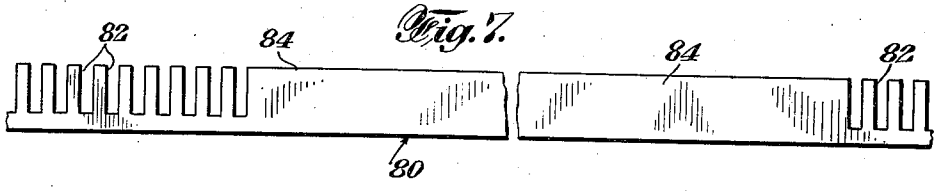


Fig. 7.



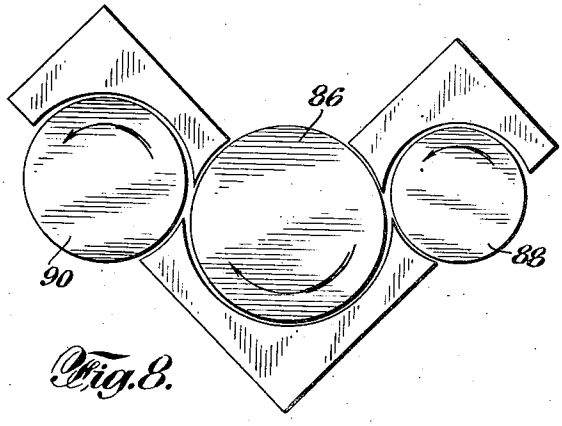


Fig. 8.

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2,180,555

UNITED STATES PATENT OFFICE

2,180,555

MACHINE AND METHOD FOR ROLLING RIVETS

Harry E. Sipe, New York, N. Y., assignor of one-fourth to Nathaniel L. Foster, Montclair, N. J.

Application June 4, 1937, Serial No. 146,328

11 Claims. (Cl. 80—18)

This invention relates to a machine and method for rolling rivets, and it is intended particularly for use with special rivets that have to be rolled to a plurality of finished diameters. In particular, this invention is useful in connection with rivets of the type which are held by the stem while a sleeve is forced around the rivet, and subsequently the stem is broken off. In such case, it is customary to roll down a relatively thin neck where the break is to occur and to provide on the length of the rivet at least two portions having ridges or burrs rolled into the rivet with these two portions being of different diameter.

Obviously it is impracticable to roll different parts of a rivet to different diameters at the same time, for this would involve varying peripheral or angular speeds. Even where the rivets are rolled between flat members, the rolling of the rivet in one operation demands an expensive and complicated die in which the different parts are rolled successively. According to my invention, rivets of this type can be rolled rapidly and economically in what amounts to a single operation.

Broadly speaking, in accordance with my invention the rivets are passed through a series of dies each comprising a circular die and a cooperating segmental die. This series is arranged so that as the rivet is discharged from one of the series, it is immediately picked up by the next. According to my method, these dies are so arranged that in the first operation that part is rolled which has the largest finished diameter and at the same time any other part which originally was of a larger diameter than this first part but ultimately is to be of smaller diameter, is brought down in size until it is equal to the rolled diameter of the part to be finished in the first operation. In other words, I operate on the rivet at a plurality of points by dies all having the same maximum diameter to give a plurality of like minimum diameters as a result of a single rolling operation, but not all of these are finished diameters. Specifically in the case of the rivet for which this process is particularly intended, in the first rolling operation I roll down one ridged portion and partially reduce in diameter the neck portion of the rivet. In subsequent operations, additional parts are rolled in like manner, and ordinarily in each operation except the last, one portion will be finished and a portion will be reduced in diameter preparatory to subsequent finishing. In the final operation, the part which is of smallest diameter is finished. Thus in the case of the special rivet referred to, the second operation rolls in a second ridged portion and reduces the neck portion to a smaller diameter than that remaining after the first operation preparatory to the final operation giving to the neck portion its ultimate diameter. By supplying dies which thus finish one part of the rivet while preparing another part for further action, I am able to get a maximum of reduction on the parts which need it most and also finish the rivet to a plurality of different diameters without needing any unduly complex design of die or undue length of contact for any one die.

Under this invention, I also supply a machine of particular merit for carrying out my process and in one particular form supply an apparatus intended for use with pins or rivets having either no head or very small heads, where the pins or rivets are carried through the machine on an endless belt.

My invention can readily be understood by reference to the accompanying drawings, in which Fig. 1 is a plan view of a machine embodying my invention and useful for carrying out the process; Fig. 2 is a section on line 2—2 of Fig. 1; Fig. 3 is an enlarged detail showing the action of a rivet in the first set of dies; Fig. 4 shows the rivet in the second set of dies, and Fig. 5 shows the rivet in the final operation of finishing. In addition, Fig. 6 is a horizontal sectional view showing the use of a continuous feed belt; Fig. 7 is a detailed view of a belt used in Fig. 6, and Fig. 8 is a diagrammatic showing of a further modification.

In the drawings, 10 is the main frame or bedplate of the machine in which are mounted the shafts 12, 14 and 16 which carry the meshing gears 18, 20 and 22. The shaft 14 is driven in any desired manner and this shaft in turn drives shafts 12 and 16 at the same speed due to the fact that the gears 18, 20 and 22 are all identical. Each of the shafts 12, 14 and 16 has an integral collar 24 against which the circular die members are forced.

Each pair of dies comprises a circular portion and an arcuate portion. Thus the shaft 16 carries the circular die 26 which cooperates with the arcuate die 28. In the same way the shaft 14 carries a circular die 30 which cooperates with the arcuate die 32, and the shaft 12 carries a circular die 34 which cooperates with the arcuate die 36. In producing the arcuate dies, it is advisable to machine the internal face of a complete ring which is then cut up into sections of appropriate size. This provides an extra arcuate die for replacement as these portions are the first to wear out.

The arcuate dies are set against bosses 38 formed integral with the bedplate 10 and are adjusted to proper relationship with the circular dies by thin shims as indicated at 40. The proper adjustment calls for the arcuate die and circular die not to be set absolutely concentric but to be so positioned that the rivet will enter the space between these two quite freely and then receive

the maximum roll pressure and then be released gradually as it passes out from between the dies. The arcuate dies are held in place by bolts 42 and are also held down by the top bearing members 44 which receive the upper ends of the shafts 12, 14 and 16.

Since only a relatively small part of the rivet is operated on by each pair of dies, it is not necessary to make the dies of a thickness equal to the whole length of the rivet, but the dies may be made of any desired thickness to take care of the work that is to be done and the rest of the thickness can be taken up by an ordinary steel filler block. The circular die members are preferably keyed to their respective shafts and each of these members is preferably provided with a pair of threaded holes as indicated at 46, so that screw members (not shown) may be screwed into these holes with the ends bearing against the flanges 24 and thereby lift off the die members when occasion arises for replacement.

When working with headed rivets, these will be supplied by any usual feed mechanism or track as indicated at 48. In order to be sure that the rivets are properly arranged longitudinally with the heads firmly pressed against the tops of the dies, and spaced apart at least enough so they do not interfere with each other as by having one head overlie the next, I supply a rubber roller 50 under which the heads of the rivets must pass. This roller is carried on a shaft 52, one end of which is mounted in the bearing member 44. The mounting for the shaft 52 is preferably in the form of a somewhat elongated slot running vertically as indicated at 54 so that the shaft 52 may be tilted. The other end of shaft 52 is caught under the hook 56. It is clear that the wheel 50 may readily be removed by unhooking the shaft from this hook and then pulling the other end out from the slotted part 54. The wheel 50 has a slightly enlarged flange 58 which bears against the flat face or top of die 26, and due to the fact that this flange is set in from the periphery of die 26, the peripheral speed of wheel 50 will be substantially less than that of die 26. It is to be borne in mind, however, that the rivets will be rolled between the rotary die and the arcuate die and therefore travel at only half the speed of the rotary die so that the wheel 50 is rotating slightly faster than the normal movement of the rivets and pushes them into place. Due to the fact that wheel 50 is made of rubber, it will have a resilient action to space the rivet heads.

While the drawings indicate the circular dies as all being of the same diameter, actually it is preferable to have the succeeding dies made progressively larger to a very slight extent and this is a natural consequence of arranging the dies to carry out my process where each succeeding set of dies rolls to a smaller diameter, which means a large diameter for the circular die. This increases the peripheral speed so that there is less danger of the rivets catching up with each other. Such arrangement is not necessary where a feed belt is to be employed as later described.

The operation of my process in the manufacture of a particular type of rivet is illustrated in Figs. 3, 4 and 5. The rivet blank before being rolled has a head 60 and three portions of different diameter 62, 64 and 66. The finished rivet is indicated in Fig. 5 where a set of ridges has been rolled into the portion 62 as indicated at 68 and also a neck of very small diameter has been rolled into this portion as indicated at 70. Nothing has been done to the portion 64 but a series of ridges have been rolled into the portion 66 raising the metal so that the maximum diameter of these ridges is substantially equal to the diameter of the portion 64.

Fig. 3 shows the operations performed by the dies 26 and 28. Since these operate only near the top of the rivet, these dies are of moderate thickness and the filler blocks 27 and 29 are supplied. In this first pass the grooves as indicated at 72 are rolled into finished shape and immediately below them the rivet is reduced to a diameter exactly equal to the minimum diameter of the grooves at 72. In other words, the maximum diameter of the die 26 is the diameter of the portions which form these grooves and the beginnings of the neck 70. As shown in Fig. 4, the second portion of the pass operates on both the top and bottom portions of the rivet and therefore the dies 30 and 32 have bottom portions 30' and 32' separated from the top portions by the spacers 31 and 33. The dies 30 and 32 operate only to reduce that portion of the rivet which is to form the neck 70 while the lower portions 30' and 32' serve to form a set of ridges as indicated at 74. The maximum diameters of the die 30 and the maximum diameters of the die portion 30' are identical, so that as the rivet is rolled through the machine, there will be no tendency to tip it from its normal vertical position. In Fig. 5 the operation of the last pass is indicated, and here as in Fig. 3, the dies 34 and 36 operate only on the top portion of the rivet to finish the neck 70 and so filler blocks 35 and 37 are supplied.

By thus arranging to have the first pass finish that part which is to have the largest diameter and at the same time partially reduce that part which needs the most rolling, and by continuing this in the second operation where another part is finished and the part which needs the most rolling is further reduced, and by then finally finishing the rivet in the last pass and by arranging the passes so that the rivet is fed directly from one to another without danger of change of alignment, I am able very efficiently to produce a rivet rolled to finished portions of three different diameters, at least one of which has demanded very extensive reduction in diameter so that a plurality of passes are desirable for giving it its finished form.

Where the rivets have the usual type of head, I find it satisfactory to feed them from an ordinary chute as already described, and align them in the rolls through the use of the wheel 50. On the other hand, if rivets are to be treated which do not have heads or where for any other reason this type of feed is not desirable, I find it advantageous to supply a belt as indicated at 80 in Figs. 6 and 7. This belt may be made of any desired flexible material preferably one having a reasonable modulus of elasticity such as a comparatively stiffly compounded band of rubber, and is provided with a series of notches indicated at 82 to receive the rivets to be rolled. The belt is advanced by the movement of the rivets between the dies and therefore no specific feed for the belt is necessary. If for any reason the rivets are advanced more rapidly through the last pass than through the first pass (as when one design of die is subject to more slippage than another) there would be a tendency to exert a strain between the rivets passing through between dies 34 and 36 and those passing through dies 26 and 28, and such strain would be cumulative on the belt. Accordingly, blank spaces are provided at intervals as indicated at 84 which are of sufficient length

so that when one of these blanks is passing between dies **34** and **36** the belt will not be under tension and will readjust to normal operation.

While I prefer to have the three sets of dies all of approximately equal diameter, this is not essential provided that the peripheral speeds of the three sets are all substantially identical. Thus in Fig. 8, I illustrate the case where the middle die **86** is of substantially larger diameter than the two exterior ones **88** and **90**. In such case the driving gears must be adjusted to correspond. Such an arrangement is useful when one of the passes demands a particular amount of work beyond that of the other two passes.

It is understood that the examples given are by way of illustration only and may be modified in many particulars without departing from the spirit of my invention.

What I claim is:

1. The method of rolling rivets and the like which are to be finished to a plurality of diameters, which comprises passing such rivets through at least three sets of interconnected dies, all of which act on at least one portion of the rivet so that the metal at that point is reduced intermittently, and, while the rivet is being rolled in at least one such set of dies, also rolling at least one other portion of the rivet to a completely finished minimum diameter equal to the minimum diameter given to the first-specified portion by that set of dies.

2. A process as specified in claim 1, in which each of the first two sets of dies reduces the diameter of said first portion and simultaneously completely finishes the rolling of another portion of the rivet to a minimum diameter equal to that given such first portion by such set of dies, and in which the said first portion is rolled to finished diameter in said third set of dies.

3. A method of rolling rivets and the like which are to be finished to a plurality of diameters, which comprises passing such rivets through at least three sets of interconnected dies, of which the first serves to finish one portion of the rivet and simultaneously to reduce the diameter of another portion of the rivet to the same minimum diameter as said finished portion so as to prepare it for treatment by the second set of dies, and in which the second set of dies while acting on the portion reduced in diameter by the first set of dies serves to finish a portion of the rivet and simultaneously to reduce the diameter of a portion of the rivet to a minimum diameter equal to the minimum diameter of the portion finished by such second set of dies so as to prepare such reduced portion for treatment in the third set of dies, and in which the third set of dies finishes that portion of the rivet prepared for the third set of dies by the second set of dies.

4. The combination of a series of sets of dies arranged to form a continuous path, each of the first two sets of dies being adapted to reduce a portion of a rivet preparatory to treatment of that portion by the next set of dies and at least one of the said first two sets of dies being adapted to roll a portion of the rivet to a completely finished diameter equal to the diameter of the partially reduced portion as formed by said set of dies.

5. In a machine for rolling rivets, a series of sets of dies each comprising an arcuate die and a cooperating circular die so constructed and arranged that the first set of dies completely finishes the rolling of that part of the rivet having the largest finished diameter and simultaneously reduces partially a part of the rivet which requires further rolling, the second set of dies being adapted to continue the rolling of the partially reduced portion and simultaneously completely to finish the rolling of another portion, the last set of dies being adapted to finish that portion partially rolled in the preceding sets of dies.

6. In a machine for rolling rivets, a plurality of sets of dies each comprising an arcuate die and a cooperating circular die, each set of dies forming a portion of a continuous path and each set of dies being adapted simultaneously to finish a portion of a rivet and to reduce partially a portion of the same rivet, the minimum diameters to which portions of the rivet are finished and reduced being equal within a particular set of dies.

7. The combination of a series of sets of dies arranged to form a continuous path, each set comprising a circular die and an arcuate die and each of the first two sets of dies being adapted to reduce a portion of a rivet preparatory to treatment of that portion by the next set of dies and at least one of the said first two sets of dies being adapted to roll a portion of the rivet to a completely finished diameter equal to the diameter of the partially reduced portion as formed by said set of dies, and means for feeding headed members to be rolled into the dies, said feeding means comprising a roller of yielding material mounted above the first pair of dies and adapted to press the heads of the members to be rolled against the top of the dies, and means for driving the roller at a speed less than the peripheral speed of the circular die, but at more than one-half that speed.

8. The combination as specified in claim 7 in which the roller carries a flange bearing against the top surface of one of the dies to drive the roller.

9. The combination of a series of sets of dies arranged to form a continuous path, each of the first two sets of dies being adapted to reduce a portion of a rivet preparatory to treatment of that portion by the next set of dies and at least one of the first two sets of dies being adapted to roll a portion of the rivet to a completely finished diameter equal to the diameter of the partially reduced portion as formed by said set of dies, and a flexible continuous belt passing through said sets of dies in a serpentine path and returning outside of said dies and having a series of notches to receive members to be rolled, whereby said belt may be caused to move through said sets of dies to feed in members to be rolled.

10. The combination as specified in claim 9 in which the belt has a blank space to relieve tension developed between sets of dies.

11. The combination as specified in claim 9 in which the belt has a blank space to relieve tension developed between sets of dies, said blank space being at least as long as the operating surface of the largest set of dies, but not as long as the aggregate path through all the dies.

HARRY E. SIPE.