

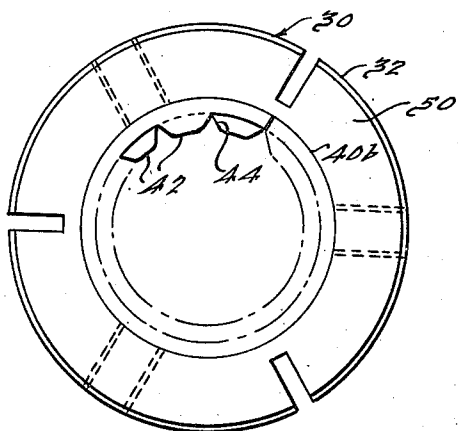
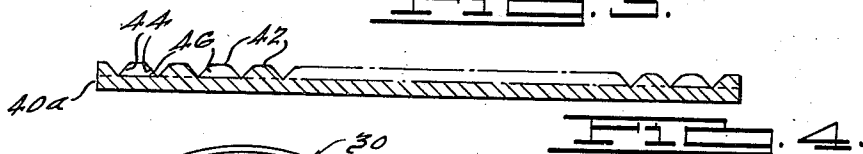
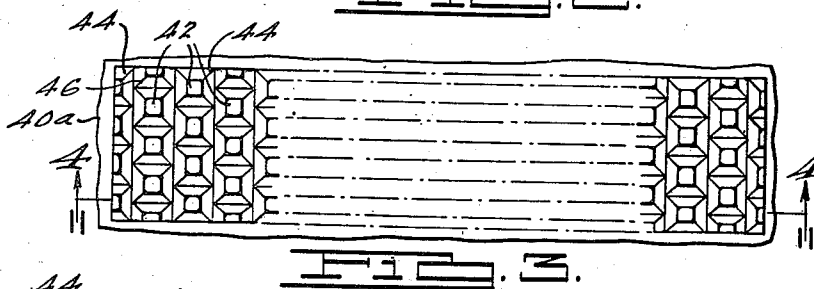
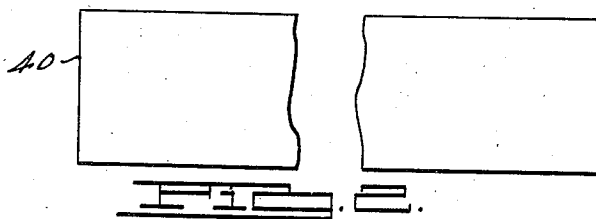
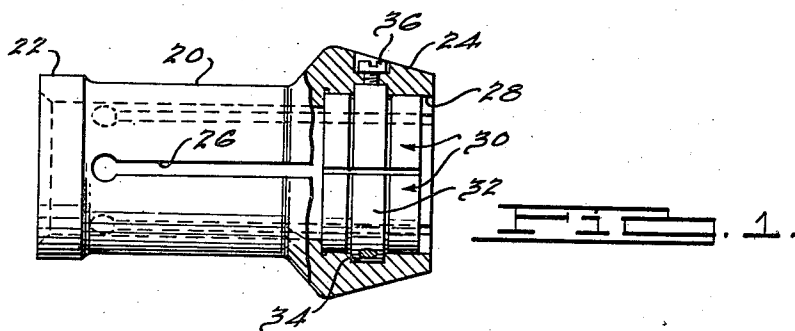
April 24, 1945.

E. C. GODFREY
COLLET OR COLLET PAD

2,374,192

Filed July 8, 1943

3 Sheets-Sheet 1



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April 24, 1945.

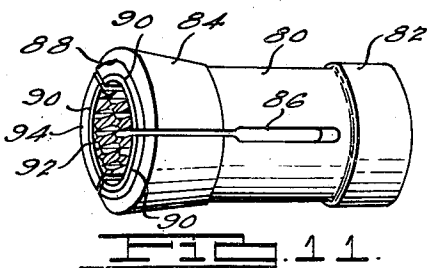
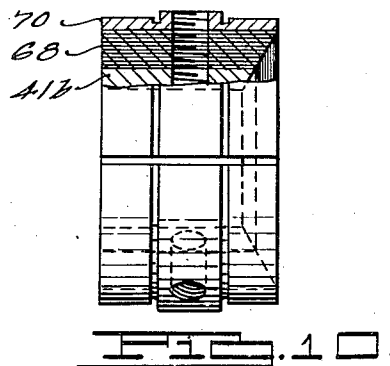
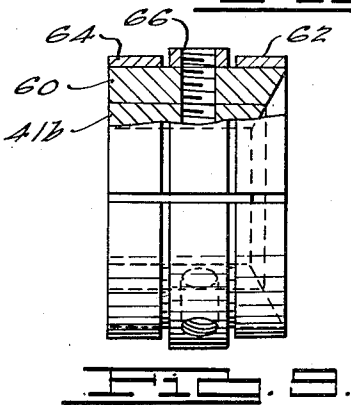
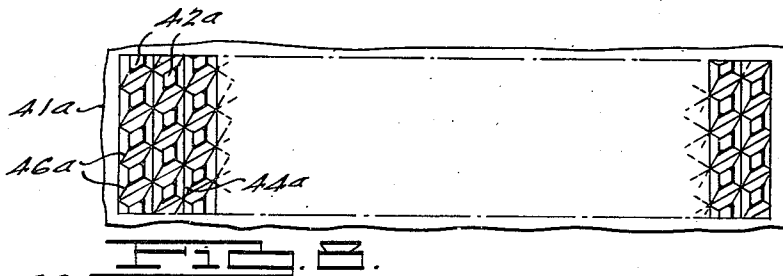
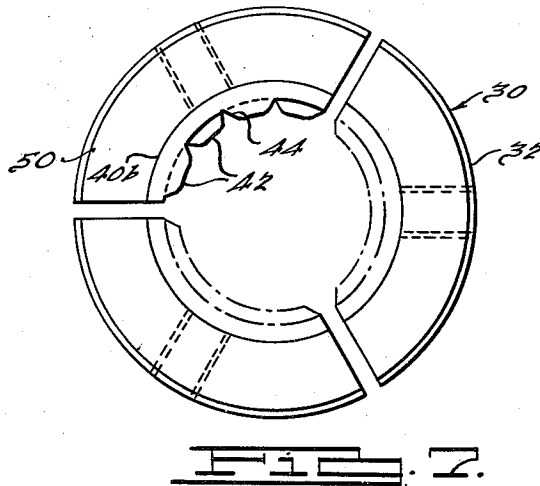
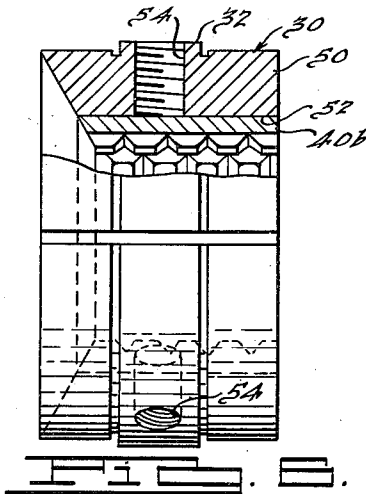
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COLLET OR COLLET PAD

Filed July 8, 1943

3 Sheets-Sheet 2



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2,374,192

COLLET OR COLLET PAD

Filed July 8, 1943

3 Sheets-Sheet 3

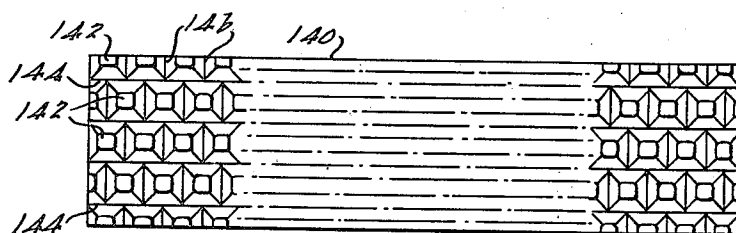


FIG. 12.

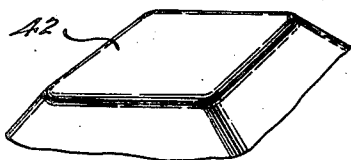


FIG. 16.

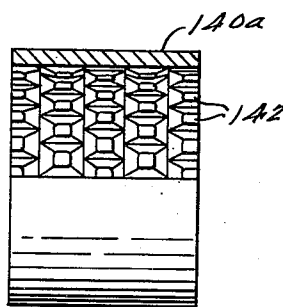


FIG. 13.

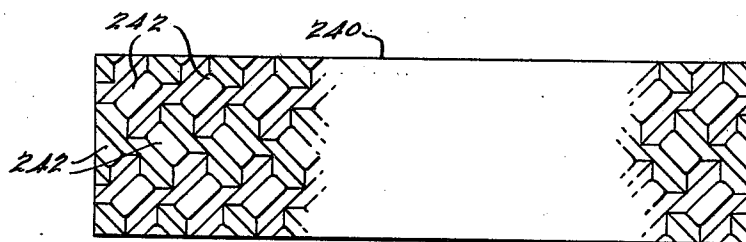


FIG. 14.

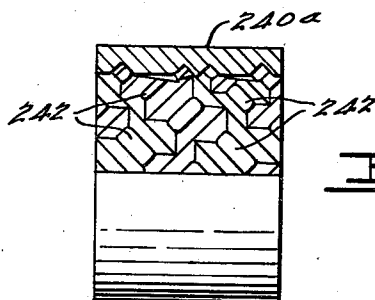


FIG. 15.

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2,374,192

COLLET OR COLLET PAD

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Application July 8, 1943, Serial No. 493,895

16 Claims. (Cl. 279—51)

This invention relates to collet or collet pads employed for gripping stock which is turned, bored, or otherwise machined in automatic or hand screw machines, or the like, the principal object being the provision of a new and novel method of manufacturing such collets or pads and to such collets or pads having a new and novel form of gripping surface.

Objects of the invention include the provision of a method of making collets or collet pads in which the gripping surfaces thereof are formed for engagement with the stock to be received thereby through a plurality of relatively small and separated surfaces or facets, and by the practice of which such facets may be formed in a more facile and economical manner than in accordance with conventional practices; the provision of a method as above described in which the collet or collet pad is made up of a plurality of parts and that part in which the separated gripping areas or facets are formed in is initially formed in flat condition; the provision of a method as above described in which the formation of that part of the collet or pad provided with the separated gripping areas or facets is formed while in flat condition to provide such areas by a rolling or forging operation; the provision of a method as above described in which the gripping surface forming portion is formed flat and then rolled into cylindrical conformation and thereafter assembled with the remaining parts thereof; the provision of a method as above described in which the gripping surface portion of a collet or pad after being formed and rolled into cylindrical conformation is surrounded by one or more annular portions telescopically associated therewith and thereafter permanently secured thereto; and the provision of a method as last described in which the interconnection of the gripping surface forming portion of the collet or pad is permanently connected to the associated portions thereof by a copper welding, brazing (hydrogen or otherwise) or other suitable operation.

Further objects of the invention include the provision of a collet or collet pad having a novel form of gripping surface; the provision of a collet or collet pad in which the gripping surface is formed to present a plurality of separated gripping areas or facets each presenting a side edge normal to the direction of the relative turning force exerted thereon by the work engaged thereby; the provision of a construction as above described in which the separated gripping areas or

facets of the collet or pad present edges parallel to both the length and the circumference of the collet or pad and in which such areas or facets are arranged in staggered relationship with respect to adjacent facets; and the provision of a 5 collet or pad of the type described in which the gripping areas or facets are of a diamond-shaped character but arranged in a new and novel manner, and the provision of a collet or pad of the type described in which the gripping facets are of generally rectangular conformation and arranged in alternate rows with the length of the facets in one row at right angles to the length of the facets in the adjacent rows.

The above being among the objects of the present invention the same consists in certain novel steps of operation, features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then claimed, having the above and other objects in view.

In the accompanying drawings which illustrate suitable embodiments of the present invention and in which like numerals refer to like parts throughout the several different views,

Fig. 1 is a partially broken, partially sectioned side elevational view of a push out type of collet to which collet pads constructed in accordance with the present invention are shown adapted and are illustrated in side elevation;

Fig. 2 is a broken plan view of a blank such as is employed in the initial step of forming the inner or gripping element of a collet or collet pad formed in accordance with the present invention;

Fig. 3 is a plan view of the blank shown in Fig. 1 after it has been operated upon to form separated gripping areas or facets therein;

Fig. 4 is a sectional view of the part shown in Fig. 3 taken as on the line 4—4 thereof and in trimmed condition;

Fig. 5 is an end elevational view showing the part disclosed in Figs. 3 and 4 as bent into a cylinder and inserted within and secured to an annular backing member;

Fig. 6 is a side elevational view of the assembly shown in Fig. 5 partially broken away to show the same in axial section;

Fig. 7 is a view similar to Fig. 5 but illustrating the assembly shown in Fig. 5 after it has been completely machined and separated into segments;

Fig. 8 is a view similar to Fig. 3 but illustrating the manner in which the blank may be formed to

provide a different type of gripping surface than that disclosed in Fig. 3;

Fig. 9 is a view similar to Fig. 6 but illustrating the inner or gripping surface element enclosed within a modified form of backing member or members;

Fig. 10 is a view similar to Figs. 6 and 9 but illustrating the inner or gripping member as being received within a still further modified form of backing member or members;

Fig. 11 is a perspective view illustrating the application of the present invention to a pull-in type of collet and in which the gripping surfaces are formed as an integral part of the collet rather than as removable pads as in the preceding views;

Fig. 12 is a view similar to Fig. 3 but showing a modification of the facet arrangement, the facets in this case being staggered in a direction opposite to that in Fig. 3;

Fig. 13 is a partially broken, partially sectioned side elevational view of the blank shown in Fig. 12 after it has been rolled into a hollow cylinder;

Fig. 14 is a view similar to Figs. 3, 8, and 12 but illustrating a further modified form of facet arrangement;

Fig. 15 is a view similar to Fig. 13 and illustrating the blank shown in Fig. 14 rolled into cylindrical conformation; and,

Fig. 16 is an enlarged perspective view of one of the facets of the construction shown in Figs. 1 to 7, inclusive, bringing out the rounded edges which are applicable to all of the constructions shown.

Collets and collet pads for screw machines or the like adapted to operate upon cylindrical stock, excepting ground stock and cold drawn stock where it is necessary to machine without marring its surface, are conventionally provided with a gripping surface for engagement with the stock made up of a plurality of relatively small and spaced gripping surfaces or facets, the reason being that this form of surface has been found to be more effective in preventing inadvertent movement between the collet and the stock than in cases where the gripping surfaces are smooth and unbroken. It will also be understood that such collets may be either of the drawn-in or push-out type, that is, in which they are formed to grip the stock when drawn inwardly with respect to the associated screw machine spindle or pushed outwardly with respect thereto.

Such collets are conventionally slotted to provide three or more equally angularly arranged and circumferentially separated pads or gripping surfaces secured together and to the main body portion of the collet by portions thereof forming flexible arms or fingers permitting radial displacement of the pad surfaces with respect to the axis of the collet for the purpose of enabling the diameter of the bore to be constricted to grip a piece of stock therein or to be enlarged to free such stock with respect thereto.

It is conventional practice to form such collets with the pad portions thereof either integral therewith or removable therefrom, the latter form of construction being usually desirable where used for quantity production inasmuch as the removable pads may be replaced when they become worn without the necessity of replacing the entire collet. The present invention is applicable to either type of construction but for the purpose of illustration only it is shown in Figs. 1 to 10, inclusive, as applied to the removable pad type and in Fig. 11 only to the integral pad type. To simplify the following description and claims

it will be understood that reference to a collet pad will mean the pad portion of a collet whether it be permanently or removably associated with the collet proper, except in cases where such interpretation is obviously inept or incorrect.

In the past it has been conventional practice to form collets substantially to shape without completely separating the various pads by the slots above described, or without separating the rings into segments when manufacturing the removable type of collet pads, then machining the inner surfaces thereof to provide the desired type of gripping surface made up of a plurality of relatively small and separated areas of facets, harden the same, and then complete the machining thereof including the final step of slotting or completing the slotting of the collet and/or separation of the ring into pads.

Heretofore there have been two general types of gripping surfaces having small separated gripping areas or facets. One of these includes separate gripping areas or facets having the front and rear edges thereof arranged in planes perpendicular to the axes of the collet or pad and the remaining surfaces parallel to the axis of the pad, with such facets arranged circumferentially in circles and with the facets in each circle aligned with the facets of the adjacent circles longitudinally of the collet or pad. In this type of construction the individual gripping areas are usually of square formation. They are usually formed by cutting circumferentially extending grooves in the bore of the collet or pad assembly, depending upon which type it is applied to, such grooves being intersected by grooves machined in such bore in parallel relation to the axis of the collet or pad.

In the other type of construction the individual gripping areas are of diamond conformation which are formed by cutting a series of right and lefthand grooves, each of the same pitch, in the bore of the collet or pad. Whichever type of gripping surface as above described is employed the operation of grooving the bore to form the individual gripping areas has entailed a material amount of time and expense and it is particularly this feature of conventional constructions and practices that the present invention is intended to improve.

Instead of making the collets when employing integral pads out of a single piece, or separate pads where employed out of a single piece of material, and machining the grooves required to form the separated gripping areas in the cylindrical bores thereof as in conventional practice, in accordance with the present invention that portion of the collet or collet pad which presents the relatively small and separated gripping areas or facets is formed separately from the remainder of the collet or pad and from a piece of flat stock. This piece of flat stock is operated upon while in flat condition to form the required intersecting grooves therein necessary to provide the facets desired in the final product. While such an operation may be accomplished by a machining operation it is preferably accomplished by a forging or rolling operation inasmuch as the expense of the operation is, therefore, materially reduced where quantities of such pads are to be produced. After such flat blank is acted upon as above described to form the individual facets the blank is bent up into cylindrical conformation, its periphery is preferably machined, and it is then inserted into or surrounded by another member which forms a backing therefor and which in

the integral type of construction may, of course, be the collet body itself, is then integrally united with the backing member, and then is completed in accordance with conventional practice. As will be appreciated by those skilled in the art the present invention thus provides a method of forming such collets or collet pads in an easy and economical manner.

The present invention further contemplates the provision of a collet or collet pad having the above-mentioned small separated gripping areas or facets of new and novel conformation. One of these types provides many of the advantages of the so-called diamond type of surface but in this case the diamonds are so positioned as to present one edge thereof normal to the line of force between it and a piece of work gripped by the collet or pad tending to turn the work in the pad, this providing a type of construction which is believed to exert a firmer grip on the work and is less liable to mar or scuff the work than in conventional diamond types of construction. The other type of construction provides such facets of square conformation and in which opposite edges of each facet lie in planes perpendicular to the axis of the collet or pad and the remaining edges thereof lie in parallelism to the axis of the collet or pad, the facets being arranged in spaced lines with the facets of one circle staggered, either circumferentially, axially or diagonally with respect to the areas of the next adjacent circles. This form of construction gives a superior type of gripping surface and one that is amenable to manufacture only by the methods of the present invention as it appears to be commercially impossible to machine this type of surface when in cylindrical conformation.

Referring now to the accompanying drawings and particularly to Fig. 1 a collet of the removable pad type is shown, the forward end of the same being broken away to show the removable collet pads in side elevation therein and removably secured thereto. It will be observed that the collet body or master type collet illustrated in Fig. 1 includes a hollow cylindrical main body portion 20 having a circumferentially unbroken rear end portion 22 of sufficient thickness to prevent ready distortion thereof. The forward end of the collet is thickened and inasmuch as the particular collet shown is of the push-out type its forward end is tapered axially outwardly and radially inwardly as at 24 into frusto-conical conformation. The main body portion 20 and end portion 24 are axially slotted at equally angularly spaced positions around its circumference, shown as three which is usually the case where the collet is adapted to receive cylindrical stock although a greater or lesser number of slots may be employed if desired. It will be noted that the slots 20 extend from near the rear portion 22 completely through the front end of the collet so as to form the slotted portion of the collet into three spring arms or fingers for well known purposes. In the particular construction shown the front end 24 is bored out as at 28 concentrically with the axis of the collet and to a greater diameter than the bore of the main body portion 20. Within the bore 28 is received a plurality of collet pads 30, these being equal in number to the number of fingers formed by the slots 26 and being centrally arranged with respect to such fingers.

In accordance with the broader aspects of the present invention the external conformation of the pads 30 and the particular manner in which they are secured within the bore 28 is of no im-

portance but in the particular construction shown by way of illustration each pad 30 is provided with a radially projecting circumferentially directed rib portion 32 and the bore 28 is centrally grooved as at 34 for complementary reception of the ribs 32. The ribs 32 in engaging the grooves 34 serve to maintain the pads 30 against axial movement with respect to the master collet, that is the portions 20, 22, and 24, in service. To removably secure the pads 30 in place a screw such as 36 is projected through each segment of the end 24 preferably centrally thereof and threaded into its associated pad 30. Ordinarily there will be a sufficient clearance between the adjacent ends of the pads 30 to permit the ribs 32 to be withdrawn from the co-acting groove 34 upon removal of the screws 36 to permit withdrawal and replacement of the pads 30, and the resilient fingers formed in the master collet by the slots 26 permit the outer ends of the fingers to be sprung outwardly to facilitate this operation if necessary.

It will be understood that the collet pads 30, only the outer surfaces of which are shown in Fig. 1, are internally formed to provide a gripping surface made up of a plurality of small and separated gripping areas or facets.

In forming the pads 30 in accordance with the present invention the first operation consists in providing a piece of flat stock of the desired thickness, such as illustrated at 40 in Fig. 1, and of a width slightly greater than the axial length of the pads 30 as viewed in Fig. 1. The piece or strip 40 may either be formed of a type of steel that in itself is hardenable by heating and quenching, or it may be of the type of steel that is not capable of being materially hardened by heating or quenching but which is amenable to being hardened by subjecting it to a case hardening operation. Where of the first type it will, of course, be maintained in its soft condition until the actual hardening operation. It may be of a length slightly exceeding that required to form the inner portion of a set of pads 30 when bent into cylindrical or sleeve-like conformation, or it may be of a length many times greater and after the facet forming operation then cut to length.

The piece of stock 40 is then acted upon while in flat condition to so form one surface thereof as to provide a plurality of relatively small and separated upstanding areas or facets 42, as illustrated in Fig. 3 and which are to form the individual gripping areas in the final product. The facets 42 may be formed by either machining one surface of the blank 40 or by forging such blank to provide such surfaces either while the blank is in hot or cold condition. Cold forging or rolling is preferable inasmuch as it is more economical to perform and results in a better grained structure of the material from which the blank is formed and it is preferable to employ a relatively long piece of stock 40 and form the facets by a rolling operation, that is, by passing the piece of stock between a pair of rollers one of which is peripherally formed to provide a die face complementary to the facets to be formed, as this method is more economical to use. In such case, after the stock has been operated upon to form the facets thereon, the stock is cut to such a length that when rolled into a hollow cylinder it will be of the required diameter. Rolling and forging are, of course, equivalent steps simply using different types of dies, and where not otherwise specified in the following specifica-

tion and claims the term "forging" is intended to mean rolling as well.

Another advantage of forging or rolling the facets in the blank as compared to machining them therein is that the facets may be provided with rounded or radiused corners or edges as brought out in Fig. 16. This figure shows one of the facets for the construction shown in Figs. 1 to 7, inclusive, but it will be understood that the facets of the structure shown in the remaining views are preferably similarly rounded. This feature is of an advantage because of the fact that when machined as in conventional practice, after the pads or inserts have been hardened they are then internally ground to proper size and often leave ragged edges on the facets which tend to unduly mark the work gripped thereby. Where the facets are formed with rounded edges as is possible in accordance with the present invention when formed by a forging or rolling operation, the above similar grinding step simply cuts away part of the rounded surface and eliminates the possibility of such ragged edges occurring.

The particular type of facet 42 thus formed on the blank 40 in accordance with the broader aspects of the present invention may be equivalent to either of the types conventionally employed or any other suitable type. The particular type of facet illustrated in Figs. 3 and 4, however, is believed to have marked advantages over those conventionally employed and constitutes a more limited phase of the present invention. It will be noted from an inspection of Figs. 3 and 4 that the facets 42 are square in plan or face view and are arranged in line extending transversely of the length of the blank and, therefore, in lines which will be parallel to the axis of the collet in the final product. These lines are formed by transversely grooving the blank 40 with V-shaped grooves 44 as illustrated in Figs. 3 and 4. It will be noted, however, that the facets 42 of one transverse line are transversely staggered with respect to the facets 42 in the next adjacent line and this is accomplished by longitudinally grooving the areas between the grooves 44 as at 46, such grooves 46 occurring in longitudinally extending lines skipping every other area between the grooves 44 and such longitudinal lines of grooves 46 being staggered transversely of the length of the blank. As will be appreciated this results in the arrangement first described, that is with the facets 42 aligned transversely of the blank but staggered longitudinally thereof so that in the final product they are arranged in circles about the axis of the collet and the facets in each circle are circumferentially staggered with respect to those in the next adjacent circle. It will be appreciated that this type of facet would be substantially impossible to form in a commercially satisfactory manner in quantities by a machining operation within a cylindrical bore and would even be difficult to machine when formed in a flat blank as shown, but it will be appreciated that they may be as readily formed as any other shape by a forging operation.

After the blank is brought to the condition illustrated in Fig. 3 its sides and ends are then trimmed off to the proper dimensions so that in the following step, which consists of bending the blank into a hollow cylinder, indicated at 40b in Figs. 5, 6, and 7, with the opposite ends thereof in substantial contact with each other, the internal diameter of such hollow cylinder will be slightly smaller than that required in the finally completed product. The outside diameter is then

preferably turned to insure a perfectly cylindrical surface of the desired diameter, this particularly in view of the fact that because of the facets it is difficult to roll the blank into a cylinder having a perfect cylindrical peripheral surface. The hollow cylinder 40b thus formed may then be secured directly within the bore of a collet where it is to be of an integral construction or, and particularly where it is to be employed in a removable pad type of collet, then into an annular member serving as a backing member therefor and in which case the member 40b serves in the nature of a liner.

In the construction illustrated in Figs. 5, 6, and 7 and as particularly brought out in Fig. 6 it is assumed in the present case, as previously described, that the removable pad type of device is being formed and in such case a cylindrical one-piece backing member 50 is provided as the backing member. The annular member 50 is provided with a bore 52 in which the blank 40 of Fig. 2 and 40a of Fig. 3 and which is illustrated in Figs. 5, 6, and 7 at 40b in cylindrical form, is relatively closely received. In Figs. 5, 6, and 7 it will be appreciated that the backing member 50 is in partially, or in Fig. 7 completely finished condition, whereas it will be understood that when the liner 40b is first inserted therein it will be sufficiently over sized to provide the necessary material for subsequent machining operations. The periphery of the backing member 50 at such time will, however, be continuous and preferably unslotted but will be preferably provided at angularly spaced intervals in its circumference with threaded holes 54 for subsequent reception of the securing screws 36.

After the liner 40b has been inserted in the backing member 50 then it is suitably and preferably permanently secured in place therein. While any suitable means and method may be employed for this purpose it is preferred to employ the so-called copper weld hydrogen brazing operation involving the application of a copper ring to the joint between the two parts and insertion in a hydrogen or other suitable furnace to cause the copper to melt and be dispersed in the joint between the two parts 40b and 50 by capillary attraction, thereby forming when cooled a permanent joint of well known character between the two parts.

The next operation consists in turning the annular assembly thus provided to approximately the desired external and axial dimension, leaving, of course, enough stock to provide for a cleaning up operation in the subsequent and final grinding operation. After this has been done the backing member 52 is longitudinally slotted as brought out in Fig. 5 at equally angularly spaced points corresponding with the number of pads to be formed in the final product, in the particular case shown three. After this has been done, then in the event that the blank 40 has been formed from self-hardening steels the assembly is heated and quenched to cause the same to be hardened, and if it has been formed of non-hardening steel then it is subjected to a case hardening operation to provide the required surface hardness therefor. After the hardening operation the assembly is completely ground, including grinding the bore of the assembly to bring it to the desired internal diameter, after which the slots 56 are extended through the liner 40b by means of a so-called rubber grinding wheel, thus separating the assembly into the three pads illustrated in Fig. 7 and shown assembled in the master collet in Fig.

1, and in which condition they may be secured in the master collet illustrated in Fig. 1 by means of the screws 36 previously described.

From the above it will be appreciated that the relative complicated machining now required in forming facets equivalent to the facets 42 in accordance with conventional practice and which constitutes one of the major items of cost in the production of these devices at the present time, is eliminated, together with a major portion of the cost thereof. While at first glance it might appear that the cost of initially making up these pads from two separate parts (instead of from an integral part as in conventional practice) and thereafter hydrogen brazed or otherwise securing these parts together might more than make up the difference in cost, such is actually not the case, these added operations in accordance with the present invention being relatively cheap and quick to perform.

In Fig. 8 a blank 41a corresponding to the blank 40a previously described is shown and as being provided with facets 42a, corresponding with the facets 42 previously described, of a modified conformation. In this case the facets 42a are formed in the flat blank by providing transverse V-sectioned grooves 44a, corresponding with the grooves 44 previously described, and transverse grooves 46a. The grooves 46a instead of being interrupted as the grooves 46 previously described are continuous and instead of extending longitudinally of the blank 41a extend preferably at an acute angle with respect to such length, the intersecting grooves thus forming the facets 42a into diamond-shaped conformation. In this case, however, instead of being the same as the diamond-shaped facets conventionally employed it will be appreciated that when the blank 41a is rolled up into a liner such as the liner 40b illustrated in Figs. 5, 6, and 7, the diamond-shaped areas in the present case will be provided with opposite side surfaces which lie in parallelism to the axis of the collet and/or pad while the remaining surfaces will lie on a helix with such axis of the collet or pads as a center. This arrangement, as differentiated from the diamond-shaped areas of conventional pads, provides side surfaces which extend in a direction normal to the direction of turning force exerted between the pads and the work gripped thereby and thus provide a maximum amount of gripping effect on the work but yet disposes of the disadvantages occurring with conventional diamond-shaped areas of unduly scuffing or marring the surface of the work.

In Fig. 9 a modified construction of the backing member for the liner 40b illustrated in Figs. 5, 6, and 7 or the equivalent backing member made from the blank 41a illustrated in Fig. 8 is shown. As a matter of illustration it may be assumed that the liner illustrated at 41b in Fig. 9 has been formed from the blank 41a shown in Fig. 8 and has been formed therefrom in substantially the same manner as the liner 40b was formed from the blank 40a as above described. In Fig. 9 the liner 41b is shown inserted in a backing member 60, such backing member 60 in this case having been formed from a mass of powdered or granular or cast metal, such as sponge or powdered iron molded into shape and sintered to secure the various particles thereof together. In turn it is surrounded by three rings 62, 64, and 66 preferably formed from seamless steel tubing and pressed upon the member 60. The rings 62, 64, and 66 may initially be made as one-piece and there-

after machined as shown to separate one from the other. This whole assembly is pressed together as illustrated and is then secured into an integral or unitary assemblage in the same general manner as in the construction first described, that is any suitable manner but preferably by a hydrogen brazing process. After the assembly has been secured together in the manner illustrated then it is completed in substantially the same manner as the construction previously described.

In Fig. 10 a still further modified method of forming the completed assembly is shown. In this case the liner may be identical to either the liner 40b or 41b but for the purpose of illustration is assumed to be identical to the liner 41b. After the liner 41b has been brought to the hollow cylindrical conformation shown, then a strip 68 of relatively thin metal, preferably steel, of a width substantially equal to or slightly greater than the axial dimension of the liner 41b is simply wound about the liner 41b until it reaches a predetermined diameter, whereupon if the strip is of excess length the excess is cut therefrom. This assembly is then surrounded by a sleeve-like part 70, preferably pressed into position. This entire assembly is then formed into an integral part or unit by a hydrogen brazing operation of the type above described after which it is finished in substantially the same manner as described in connection with the first described construction.

It has been previously mentioned that the present invention is applicable to collets where the gripping surfaces thereof form an integral part thereof or in which they are formed as removable pads as disclosed in the above described figures. For the purpose of illustration in Fig. 11 a collet is shown of the draw-in type and in which the gripping surfaces form an integral or unitary and non-removable portion thereof. Referring to Fig. 11 it will be noted that the collet there shown includes a main body portion 80 equivalent to the portion 20 of the collet first described, a portion 82 equivalent to the portion 22 of the collet first described, and a tapered end portion 84 in this case reversed in direction from the tapered end portion 24 of the first described construction inasmuch as in the present case the collet is of the draw-in type. The body 80 and end 84 are longitudinally slotted as at 86, the slots being similar to and for the same purpose as the slots 26 first described. In this case the main body portion 80 and ends 82 and 84 are formed from an integral piece of steel or other suitable material and the end 84 is provided with a bore 88 in which three separate pad assemblies indicated generally at 90 are received and secured preferably by a hydrogen brazing operation as above described or in any other suitable manner. Each pad 90 comprises a liner portion 92 and a backing portion 94, the liner portion 92 in this case being assumed to have been formed from a blank of the character illustrated in Fig. 8 bent to cylindrical conformation and received within a cylindrical collar 94 which may, for instance, be similar to the collar or backing member 50 first described, or similar to the parts 60-66, inclusive, of Fig. 9 or parts 68 and 70 of Fig. 10, and pressed into the bore 88 of the end 84 of the collet. In this case it is preferable to effect the welding or brazing of the liner 92 to the backing member 94 and the backing member 94 to the collet end 84 in a single copper weld or other operation, after which the assembly may be hardened and the slots 86 in the main body 80 and end portion 84 may be continued on through the liner

92 and backing member 94 following the subsequent hardening and grinding operation to separate the pads one from another.

In Figs. 12 and 13 a modification of the facet arrangement illustrated in Figs. 1 to 7, inclusive, is shown. Arrangement of the facets in this case is essentially similar to the arrangement best shown in Fig. 3 except that in this case the facets 142, corresponding with the facets 42 in Fig. 3, are formed by continuously grooving the blank 140 with V-shaped grooves 144 extending longitudinally of the blank instead of transversely as in Fig. 3, and the transverse grooves 146, corresponding with the grooves 46 of Fig. 3, are interrupted in the same manner as the longitudinal grooves 46 in Fig. 3. As will be appreciated this arrangement causes the facets 142 to be staggered axially of the cylindrical sleeve formed therefrom, as illustrated in Fig. 13, instead of circumferentially as in the case of the construction shown in Fig. 3. The type of construction illustrated in Fig. 12 may be preferred to that illustrated in Fig. 3 for certain types of operation.

A still further form of facet arrangement is illustrated in Fig. 14. In this case the blank is illustrated at 240 and the facets are illustrated at 242. The facets 242 are of rectangular conformation and preferably of a length twice the dimension of the width. It will be noted from an inspection of Fig. 14 that the facets 242 are arranged in rows longitudinally of the blank 240 with the facets of both rows arranged with their lengths at approximately 45 degrees to the length of the blank 240 and with the length of the facets 242 in one row arranged in perpendicular relationship with respect to the length of the facets in the next adjacent row, the grooves between them being formed to result in this arrangement. It will be appreciated that this arrangement results in what may be termed a paving block design in which the facets overlap one another both axially and circumferentially and, therefore, provides a superior type of gripping surface.

Having thus described my invention, what I claim by Letters Patent is:

1. In the manufacture of collet pads, the steps of operating upon a flat piece of stock to form relatively small and separated outstanding gripping facets on one face thereof, rolling said piece of flat stock into cylindrical conformation with said facets on the radially inner side thereof to form a liner, surrounding said liner with a backing member and permanently securing it thereto, and thereafter subjecting the resulting assembly to a hardening operation and then separating it into segments.

2. In the manufacture of collet pads or the like, the steps of operating upon a piece of flat stock to provide one surface thereof with a plurality of upstanding gripping facets separated one from another, rolling said piece of stock so formed into a hollow cylinder with said facets thereof on the interior thereof to form a liner, surrounding said liner by an annular backing member and permanently securing it thereto, machining the resulting assembly to approximately that desired in the final product, subjecting said assembly to a hardening operation whereby to harden said liner, finish machining the exterior and interior surface of said assembly, and then splitting said assembly into segments.

3. In the manufacture of collet pads or the like, in combination, the steps of forging a flat blank to produce upstanding facets of limited extent upon one surface thereof and in spaced re-

lation with respect to each other, forming said flat blank into a hollow cylinder with said facets on the inner surface thereof, surrounding said hollow cylinder by a backing means and permanently securing said backing means thereto, hardening said projecting areas, and separating the assembly into segments.

4. In the manufacture of collet pads, the steps of cold forging a flat piece of stock to produce a plurality of upstanding and spaced facets on one face thereof, forming said blank into a hollow cylinder with said facets on the interior thereof, surrounding said hollow cylinder with an annular backing element and permanently securing it thereto, axially slotting said backing element at equally angularly spaced points thereabout without severing said assembly into disconnected parts, subjecting said assembly to a hardening operation whereby to harden said facets, completing the external and internal machining of said assembly, and then extending said slots through the thickness of said assembly whereby to separate it into individual segments.

5. In the manufacture of collet pads, the steps of cold forging a flat piece of stock to produce a plurality of upstanding and spaced facets on one face thereof, forming said blank into a hollow cylinder with said facets on the interior thereof, surrounding said hollow cylinder with a solid metallic ring and permanently securing it thereto, axially slotting said backing element at equally angularly spaced points thereabout without severing said assembly into disconnected parts, subjecting said assembly to a hardening operation whereby to harden said facets, completing the external and internal machining of said assembly, and then extending said slots through the thickness of said assembly whereby to separate it into individual segments.

6. In the manufacture of collet pads or the like, in combination, the steps of forging a flat blank to produce upstanding facets of limited extent upon one surface thereof and in spaced relation with respect to each other, forming said flat blank into a hollow cylinder with said facets on the inner surface thereof, surrounding said hollow cylinder by a ring of sintered material, surround said ring of sintered material with a second solid metallic ring and permanently securing said backing means thereto, hardening said projecting areas, and separating the assembly into segments.

7. In the manufacture of collet pads, the steps of cold forging a flat piece of stock to produce a plurality of upstanding and spaced facets on one face thereof, forming said blank into a hollow cylinder with said facets on the interior thereof, wrapping a strip of metal about said hollow cylinder to form a plurality of layers on said strip thereon, enclosing said hollow cylinder and said strip of metal wound thereabout within a solid ring of metal and permanently securing it thereto, axially slotting said backing element at equally angularly spaced points thereabout without severing said assembly into disconnected parts, subjecting said assembly to a hardening operation whereby to harden said facets, completing the external and internal machining of said assembly, and then extending said slots through the thickness of said assembly whereby to separate it into individual segments.

8. In a stock engaging collet for screw machines or the like, a tubular body having a plurality of slots opening out through an end thereof thereby defining an annular series of transversely

grooved spring fingers, said fingers being provided with stock engaging means having the inner stock engaging surfaces thereof formed to provide two series of spaced grooves therein, one of said series extending circumferentially of said surfaces and the other of said series extending axially of said surfaces, the grooves of one of said series being continuous and the grooves of the other of said series being formed in the alternate spaces between adjacent grooves of the first-mentioned series.

9. In a stock engaging collet for screw machines, a tubular body having a plurality of slots opening out through an end thereof thereby defining an annular series of transversely curved spring fingers, said fingers being provided with stock engaging means having the inner stock engaging surfaces thereof formed to provide a series of circumferentially spaced, continuous axially extending grooves and a series of axially spaced circumferentially extending grooves, the last-mentioned grooves being non-continuous and being provided in the alternate spaces between pairs of the first-mentioned grooves circumferentially of said surfaces and staggered axially of said surfaces with respect to the next adjacent of the last-mentioned grooves.

10. In a stock engaging collet for screw machines, a tubular body having a plurality of slots opening out through an end thereof thereby defining an annular series of transversely curved spring fingers, said fingers being provided with stock engaging means having the inner stock engaging surfaces thereof formed to provide a series of axially spaced continuous circumferentially extending grooves and a series of circumferentially spaced axially extending grooves, the last-mentioned grooves being non-continuous and each being provided in the alternate spaces between the pairs of the first-mentioned grooves axially of said surfaces and staggered circumferentially of said surfaces with respect to the next adjacent of the last-mentioned grooves.

11. In a stock engaging collet for screw machines, a tubular body having a plurality of slots opening out through an end thereof thereby defining an annular series of transversely curved spring fingers, said fingers having the inner stock engaging surfaces thereof formed to provide a series of spaced helical grooves of the same hand therein, and a plurality of axially extending circumferentially spaced grooves intersecting the first mentioned grooves, whereby to provide a plurality of diamond-shaped gripping facets each arranged with its major axis on a helical line concentric with said surfaces but at an angle to the helix of the first mentioned groove.

12. In a stock engaging collet for screw machines, a tubular body having a plurality of slots opening out through an end thereof thereby defining an annular series of transversely curved spring fingers, said fingers being provided with stock engaging means having the inner stock engaging surfaces thereof formed to provide a series of spaced helical grooves of one hand and a series of spaced helical grooves of the opposite hand, each of said series of grooves comprising a plurality of sub-series, the grooves of each of said sub-series being of relatively short angular extent about the axis of said surfaces and the grooves of each of said sub-series being separate from and

helically mis-aligned with respect to the axes of said surfaces from the grooves of the next adjacent sub-series.

13. In a stock engaging collet for screw machines, a tubular body having a plurality of slots opening out through an end thereof thereby defining an annular series of transversely curved spring fingers, said fingers being provided with stock engaging means having the inner stock engaging surfaces thereof formed to provide a series of spaced helical grooves of one hand and a series of spaced helical grooves of the opposite hand, each of said series of grooves comprising a plurality of sub-series, the grooves of each of said sub-series being of relatively short angular extent about the axis of said surfaces and the grooves of each of said sub-series being separate from and helically mis-aligned with respect to the axes of said surfaces from the grooves of the next adjacent sub-series, the grooves of each of said sub-series terminating at their opposite ends at grooves of one of said sub-series in the series of the opposite hand.

14. In a stock engaging collet for screw machines, a tubular body having a plurality of slots opening out through an end thereof thereby defining an annular series of transversely curved spring fingers, said fingers being provided with stock engaging means having the inner stock engaging surfaces thereof formed to provide a series of spaced helical grooves of one hand and a series of spaced helical grooves of the opposite hand, each of said series of grooves comprising a plurality of sub-series, the grooves of each of said sub-series being of relatively short angular extent about the axis of said surfaces and the grooves of each of said sub-series being separate from and axially offset with respect to the axes of said surfaces from the grooves of the next adjacent sub-series and offset from the center of the grooves of the last-mentioned sub-series, whereby to form rectangular facets disposed in rows extending circumferentially of said surfaces and with the facets of each of said rows arranged with their long edges perpendicular to the long edges of the facets in the next adjacent rows.

15. In a stock engaging collet for screw machines or the like, a tubular body having a plurality of slots opening out through an end thereof thereby defining an annular series of transversely grooved spring fingers said fingers being provided with stock engaging surfaces at the outer ends thereof, and facets having rounded edges formed on said surfaces.

16. Stock engaging means for a stock engaging collet of the type having a tubular body slotted out through an end thereof thereby defining an annular series of transversely curved spring fingers to the inner faces of which said stock engaging means are secured, the inner faces of said stock engaging means each providing a concave partially cylindrical surface formed to provide two distinct series of grooves therein, the grooves of each of said series being arranged in parallel and spaced relation with respect to each other, the grooves of one of said series extending transversely with respect to the grooves of the other of said series, and grooves of at least one of said series being non-continuous and broken in length by ungrooved portions of said surface.

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