

Feb. 6, 1962

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3,019,724

MARKING DIES AND THE LIKE

Filed April 27, 1959

2 Sheets-Sheet 1

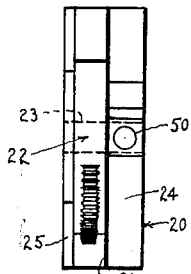


Fig. 4.

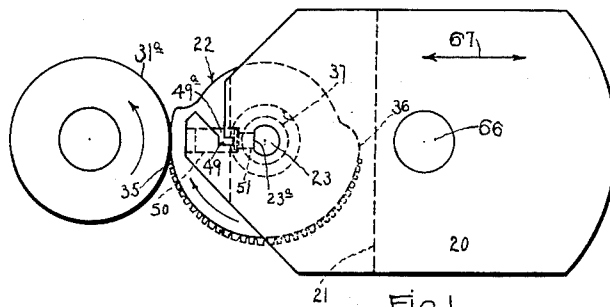


Fig. 1.

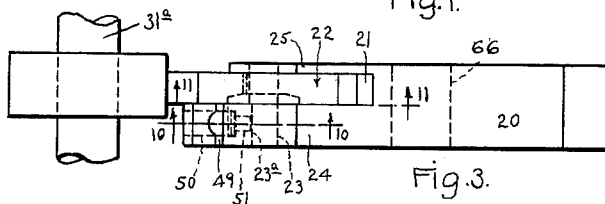


Fig. 3.

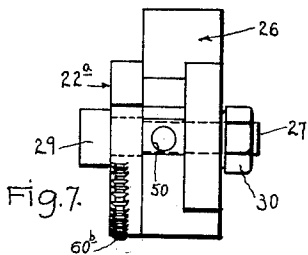


Fig. 7.

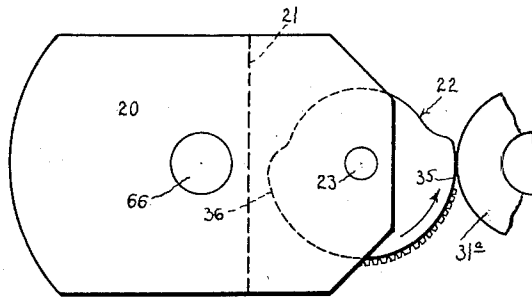


Fig. 2.

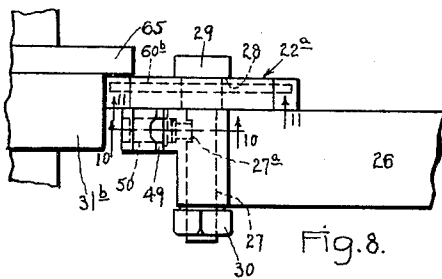


Fig. 8.

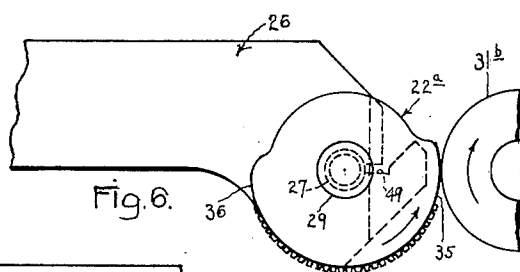


Fig. 6.

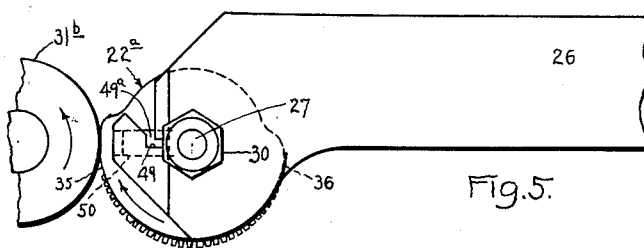


Fig. 5.

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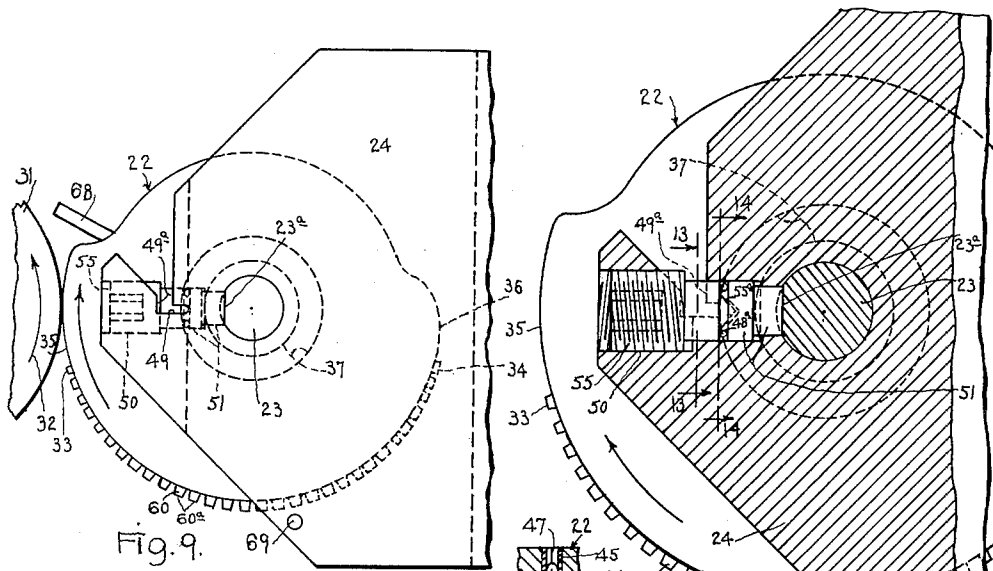
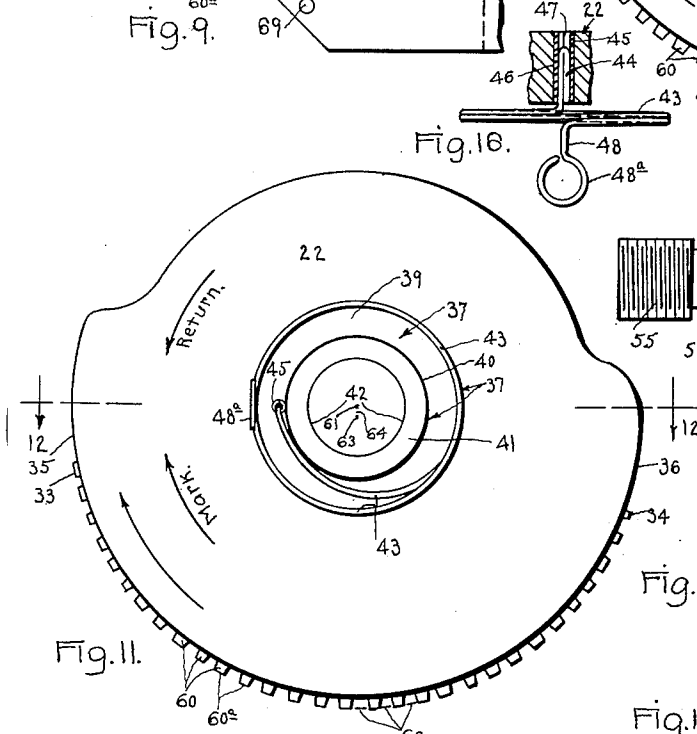
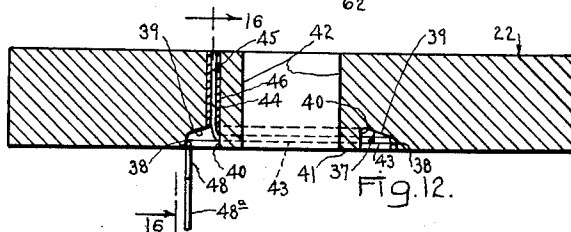
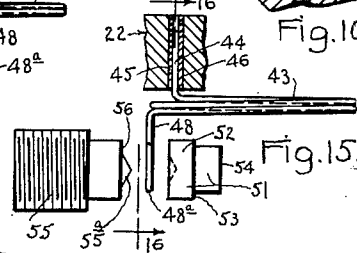
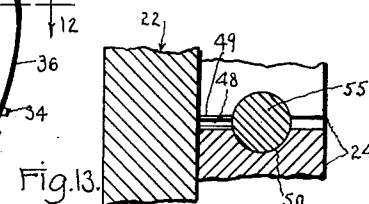
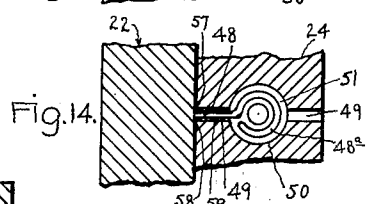
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MARKING DIES AND THE LIKE

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2 Sheets-Sheet 2



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3,019,724

MARKING DIES AND THE LIKE

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4 Claims. (Cl. 101-7)

This invention relates to improvements in marking dies, and the like. By the term "marking dies" I contemplate dies which are used for imprinting characters, indicia, and other desired symbols into objects, generally of metal or other relatively hard composition by an impressing operation under sufficient pressure to effect the desired imprinting. Marking dies of this kind include rotary or disk shaped die elements journaled to a carrier shaft or stud which is so supported that it may be moved toward the moving work body to bring the die characters or symbols into imprinting engagement with such moving work body while such work body continues its movement. Thereupon the die element is caused to move with such work body during such engagement, bringing its characters or symbols successively into imprinting engagement with the moving work body. When the series of characters or symbols has thus been imprinted into the surface of the work body the engagement of the marking die with such work body is terminated and such marking die unit is retracted into position for performance of a succeeding marking operation.

Specifically, the present improvements relate to that type of marking die in which the rotary or disk shaped die element is journaled for rotary movement between a starting position and a terminus position, with provision for returning such die element to its starting position when each marking operation is completed. This returning or retracting operation being performed by a spring element which is wound during the marking operation and delivers its returning drive by unwinding of such spring element to return the die element to its starting position. Marking dies of this general type have been well known and widely used for a long time; but as heretofore known and designed and built they have been subject to serious objections.

A basic or fundamental object is to provide a rotary die marking unit in which the retraction of such die element is produced by a spring which is fully enclosed within the body of such die element with the exception of that end portion of such spring which must be anchored stationary to produce torque as the spring is wound. Also to provide such an arrangement in which the die wheel is journaled on a stationary stud, the spring element being contained in a socket or recess of the die wheel with one end of such spring connected to such wheel, and its other end connected to a stationary element. Furthermore, an important object of my improved spring arrangement, fully enclosed within the rotary die element, is to prevent any change being made in the calibrated tension or urge produced by such spring so that the spring may be pre-calibrated at the shop where the rotary die element is produced, to exact tension which will thereafter produce the exact desired retracting effect, even after long and continuous use of the unit.

In connection with the foregoing, it is also an object of the invention to so form the holder of the stud whereon the die wheel is journaled, that the anchored end of the spring element will be readily brought into exact and correct position on such holder to accurately perform its intended spring operations when the die wheel is also set into place on its journal.

It is desirable to produce "pre-loading" of such spring element so that a die restoring spring urge is produced immediately that any movement of the die element oc-

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curs. This result is produced by so arranging the socket of the die element that when the spring element is seated therein prior to setting such die element into journalling position with respect to the carrier, such spring element is initially under wind to that extent needed to produce the desired pre-loading thereof. The arrangement is such that the engagement of the spring into its socket of the rotary die element is complete and self-sustaining even prior to seating of such die element into place with respect to the carrier. Accordingly, such die element with its contained spring element may be removed from or restored to the carrier without disengagement of the spring element from the socket or need of re-engaging the spring into such socket.

When the retraction of the die wheel to its initial position occurs, such retraction will continue until the convolutions of the spring have again expanded into firm engagement with the outer wall perimeter of the socket. At that point the expanding operation must cease since the spring is now locked and its pre-loading is fully taken up by engagement of its convolutions with the outer perimeter of the socket. Thus a dependable and pre-known point of retracting rotation of the rotary die will always come exactly to a known stopping or terminal position with respect to the carrier, thus, too, the die wheel will always come back to exactly the intended zone or starting position, preparatory to the next operation.

At the instant of return of the rotary die element to such zero or starting position, a strong restraining force is developed between the returning die element and the carrier, to bring the rotary movement of such die element to a halt. This restraining force is exerted against that projecting end of the spring element which is anchored to the carrier, tending to produce a shearing force on such projecting element. If desired the shear resisting ability of such projecting portion of the spring element may be increased by slight increase of the cross-section of such projecting portion; or, as hereinafter illustrated, a cushioning element may be provided to cushion the shock of arrest of the rotary movement of the die element at such stopping point. Still the terminal position of die restoring movement will not be adversely affected so that such terminal position will always be correct for the start of the succeeding marking operation.

Other objects of the invention may be stated as follows:

To provide a compact, simplified, fully enclosed self-contained roller marking die construction in which provision is included for ensuring re-setting always to the exact desired zero position; to avoid the need of providing or using any adjusting screws or other like elements to ensure correct return of the rotary die to its intended zero position; to avoid the provision of any external spring element outside of the rotary die element itself; to provide a construction of the rotary die which is fully self-contained, including the retracting spring; to provide a rotary die unit which can be used interchangeably for either right-hand or left-hand installation on the lathe or other machine tool with which it is used; to provide a marking die construction which can be readily used at any angular position around the spindle of the machine tool; to provide a rotary die marking unit which can be used for accurate and dependable marking at high rotary speeds of the work body, or at high linear speeds thereof, when used with some forms of machine tool; to provide a rotary marking die construction which can be cheaply but accurately made by use of simple and well known machine tool operations, and without requiring special operations of expensive type during such manufacture; to provide a rotary marking die unit which may be used with various forms of machine tools, and which may be supported by various kinds of carriers as needed to meet

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the constructions and operations of such various kinds of machine tools.

Other objects and uses of the invention will appear from a detailed description of the same, which consists in the features of construction and combinations of parts hereinafter described and claimed.

In the drawings:

FIGURE 1 shows a front elevation of a marking die unit embodying the features of my present invention, on substantially full scale, and it shows the rotary die element in engagement with the surface of a bar or rod which is to be die marked;

FIGURE 2 shows a back face view corresponding to FIGURE 1, but without showing the work body which is shown in FIGURE 1;

FIGURE 3 shows a top plan view corresponding to FIGURES 1 and 2;

FIGURE 4 shows an end view of the unit shown in FIGURES 1, 2 and 3, looking at the rotary die element end of the unit;

FIGURE 5 shows a right-hand side view of another embodiment of unit embodying the features of my present invention; and in this case the rotary die element and spring, and the means to anchor the stationary end of the spring, are the same as shown in the embodiment of FIGURES 1, 2, 3 and 4; but in the present case a different form of carrier is used and shown, to show that the rotary die element may be readily used with different forms of carrier;

FIGURE 6 shows a left-hand or back face view corresponding to FIGURE 5;

FIGURE 7 shows an end view of the unit shown in FIGURES 5 and 6, looking at the rotary die element end of the unit;

FIGURE 8 shows a plan view of the embodiment shown in FIGURES 5, 6 and 7;

FIGURE 9 shows, on enlarged scale as compared to previous figures, the rotary die element end of the unit, including the illustrated carrier;

FIGURE 10 shows, on still larger scale than that of FIGURE 9, the end portion of the carrier and the rotary die element; and this figure also shows more in detail the construction of the anchoring means for the stationary end of the spring element, and also the anchoring means for the journal stud whereon the rotary die element is journaled; and this figure is a longitudinal section taken on the lines 10—10 of FIGURES 3 and 8, looking in the directions of the arrows;

FIGURE 11 shows on the same scale as that of FIGURE 10 a face view of the rotary die element, the spring socket provided therein, and the spring seated into such socket under the condition of pre-loading of such spring element; and this figure is a longitudinal section taken on the lines 11—11 of FIGURES 3 and 8, looking in the directions of the arrows;

FIGURE 12 shows a cross-section taken on the line 12—12 of FIGURE 11, looking in the direction of the arrows; and this figure shows the projecting stationary end portion of the spring element;

FIGURE 13 shows a fragmentary section taken on the line 13—13 of FIGURE 10, looking in the direction of the arrows;

FIGURE 14 shows a fragmentary section taken on the line 14—14 of FIGURE 10, looking in the direction of the arrows;

FIGURE 15 shows an "exploded" view of the spring element, the connection of the same to the floor of the spring socket of the rotary die element, the loop of the anchored end of such spring element, the anvil stud which is forced into engagement with the flat of the journal stud to anchor such stud against rotation, and the locking stud which, when screwed up tight serves to engage the loop of the anchored end of the spring element and lock the same against the anvil stud, thus serving to anchor the

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spring loop end and to lock the anvil stud by one and the same operation; and

FIGURE 16 shows a view of the spring element at right-angles to the view of FIGURE 15, being a section taken on the lines 16—16 of FIGURES 12 and 15, looking in the direction of the arrows.

Referring to the drawings, in FIGURES 1, 2, 3 and 4 I have shown one embodiment of the improved rotary die as carried by one form of carrier, and in FIGURES 5, 6, 7 and 8 I have shown the same embodiment of such rotary die as carried by another form of carrier. The rotary die itself is thus of a self-contained form such that it can be used with various forms of carrier according to the machine tool with which it is to be used.

In the embodiment of FIGURES 1, 2, 3 and 4 the carrier comprises a block of metal 20 provided with a slot 21 extending from front backwardly far enough to accommodate the diameter of the rotary die element 22 with slight clearance between the root of such slot and the marking characters or symbols carried by the perimeter of such die wheel. In this case the rotary die wheel element is journaled on a cross pin or stationary stud 23 which has its ends supported by the bifurcations 24 and 25 of the carrier. In the embodiment of FIGURES 5, 6, 7 and 8 the carrier comprises a bar of metal or other suitable material 26 having a journal stud 27 set through its front end portion, the rotary die wheel 22^a being journaled on such stud. Conveniently such stud is shouldered at 28 and provided with an enlarged head 29 to set against the outer face of the die wheel, and the stud portion between the head 29 and such shouldered portion 28 constituting a journal whereon the die wheel is journaled. Such journal is made of length slightly greater than the thickness of the die wheel to ensure free running of such wheel. The nut 30 is then threaded onto the end of such stud to retain the stud firmly to the bar 26. This embodiment of FIGURES 5, 6, 7 and 8 may be termed an outboard bearing type.

Both of the foregoing embodiments include rotary die elements or wheels and spring elements of the same form, and are thus usable with such rotary die elements or wheels of standard form.

It is also here noted that for purposes of convenience in illustration and due to the manner of assembly of the parts, I have chosen to illustrate both embodiments upside down in the various figures. The assembling of each such embodiment is conveniently made while holding parts upside down since thereby the assembly of the projecting end of the spring element into the carrier is most conveniently effected. Insofar as concerns the constructions of the embodiments, however, it is of course immaterial in what position each of them is held.

The perimeter of each die element or wheel is provided with characters or symbols to be impressed on the work body. These characters or symbols extend outwardly radially to the extent needed for such operation. This feature will be referred to more fully hereinafter. Reference is now made to FIGURES 9, 10 and 11 wherein the sizes of the die elements or wheels are much enlarged as compared to previous figures.

In FIGURE 9 I have shown the work body in the form of a circular bar 31 of stock rotating in the direction of the arrow 32. Such worker bar is journaled and supported in conventional manner, as between the chuck and the back stock of a lathe, so that such work bar is driven at desired speed and properly centered. Various applications of the marking die improvements herein disclosed are possible, as will be apparent to one skilled in the art. Similar work bodies are also shown in FIGURES 1, 2 and 3, designated as 31^a and in FIGURES 5, 6 and 8, designated as 31^b. Assuming that the work body is in rapid motion (rotation, in the various showings, but not necessarily rotation, depending on the nature of the work), movement being in the direction shown by the arrows in several of the figures, upon moving the

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carrier towards such work body the perimeter of the die element or wheel will come into contact with such rotating work body and rotation of such die element will commence. Reference to FIGURES 9, 10 and 11 shows that the characters or symbols which project radially from the die wheel actually commence at the point 33 and extend around to the point 34, being generally somewhat less than 180 degrees of arc. Thus there is established an arc 35 at the beginning portion of the wheel's perimeter which is blind, but which is initially engaged against the rotating work body. Such engagement serves to bring the die wheel into rotation prior to actual engagement of the character or symbols with the surface of the work body. Likewise, there is a blind portion of the die wheel's perimeter beyond the final character or symbol, being the arc 36. The radius of this terminal blind arc is such that when the die wheel has rotated to position to bring such blind arc into engagement with the work body such die wheel will be retained in its rotated position until the carrier element is moved away from the work body to thus remove the die wheel from such work body and allow the die wheel to be rotated or retracted backwardly under spring urge to its starting or initial position. Preferably such movement of the carrier and die wheel away from the work body should be quickly performed by the operator or any machine element or part to which such carrier is connected.

It is here noted that the characters or symbols project radially from the perimeter of the die wheel by successively increasing amounts up to a maximum, and thereafter the amounts of such radial projections regularly reduce; such facts being shown in FIGURES 9, 10 and 11; and further explanation of the purposes and objectives of such arrangement will be included hereinafter.

The retraction of the die wheel to its starting (or cyclic ending) position is effected by spring means. Examination of FIGURES 11 and 12 in particular (and also FIGURES 1, 3, 9 and 10) shows the presence of a circular recess 37 extending inwardly from that face of the die wheel which is proximate to the carrier element. Such circular recess is concentric with the journal whereon the die wheel rotates. The perimeter of such recess is in the form of a wall 38 extending substantially at right-angles to the face of the wheel (being therefore parallel to the axis of rotation). From the base of such encircling wall there extends inwardly the floor 39 of the recess at a slant of approximately seventeen degrees from parallelism to the face of the wheel, and the inner perimeter of the recess is defined by the wall 40 comprising the face of the neck 41 wherein the journal opening 42 is formed, which journal opening receives the journal element. The axial dimension of the outer perimeter wall 38 is sufficient to accommodate generally two convolutions of a wire spring element 43 lying flat against such outer wall, as well shown in FIGURE 12. Thus, when the spring is fully "unwound" as shown in FIGURE 12, being that condition in which the spring has returned the die wheel to its initial or starting position, further unwinding is prevented by engagement of the spring's convolutions with such outer perimetral wall in the well known manner. In fact, with the spring in its thus unwound condition, further rotation of the die wheel in the retracting direction is prevented, assuming that the end of the spring is connected to a stationary element, as will presently appear.

The inner end of the spring (being that end closest to the floor 39 of the recess) is anchored to the die wheel. Such anchoring is conveniently effected by the following means: Such inner spring end is folded flat against itself and at substantially right-angles to the floor of the recess, so that such folded portion lies substantially parallel to the axis of die wheel rotation. Such folded portion is shown at 44 in FIGURE 12, and is also shown in fuller detail in FIGURES 15 and 16. Such folded end is then set into a thin split sleeve 45 of length somewhat less

than the length of the folded portion of the spring; and thereafter such split sleeve with its contained folded spring end is forced into a small hole 46 formed in the die wheel close to the wall of the neck 41, the hole size being such that a press fit is required to thus seat the split sleeve with its enclosed folded spring end, into such hole. The axial split of such sleeve is shown at 47 in FIGURE 16, and as the sleeve is forced home into the wheel hole such axial split of the sleeve permits slight compression of the sleeve to occur, thereby firmly gripping the folded portion or the spring end, and ensuring sufficient frictional engagement of the parts to ensure against pulling out of the spring end.

The other end portion of such spring is formed outwardly substantially parallel to the axis of wheel rotation, as shown at 48 in FIGURES 12, 13, 14, 15 and 16, so that such spring end portion extends outwardly beyond the plane of the die wheel. Such projecting end portion is designated as 48 in various figures. Such so-projecting spring end portion is to be anchored stationary. Since such spring end portion projects beyond the face of the die wheel proximate to the carrier, it must be accommodated within a recess of such carrier. I have made provision for such accommodation, and for also anchoring the projecting spring end as follows:

The nose end portion of the carrier is provided with a slotted opening 49 which extends from the face of the carrier proximate to the die wheel, inwardly of such carrier (that is, axially across such carrier), and, as shown, such slotted opening may extend completely through such carrier. The die wheel shown in FIGURES 1, 2, 3 and 4 is journaled on a stud 23 which extends across the slotted opening 21 and is supported by the bifurcations 24 and 25 of such carrier. The die wheel shown in FIGURES 5, 6, 7 and 8 is journaled on the stud 27 of that embodiment, being located on the journal of such stud by the nut 30 threaded on the outer end of such stud and the proximate face of the carrier at the opposite side of such die wheel. Each of the studs 23 and 27 is provided with a "flat" (23^a or 27^a, as the case may be), against which a suitable locking element may be forced to retain such stud against rotation during the die marking operations. A threaded opening 50 extends inwardly of the nose portion of the carrier (that is, extends substantially parallel to the face of the die wheel), and such opening communicates with such slotted opening 49 and continues, either threaded or non-threaded, into connection with the journal opening of the journal stud 23 or 27 as the case may be, at the location of such "flat" of the journal stud. When the die wheel is assembled onto the journal stud with the face of such die wheel brought into engagement with the proximate surface of the carrier, the projecting end portion 48 of the spring element extends into and is accommodated within the slotted opening 49, and such spring end portion also crosses the opening 50 which extends towards the "flat" of the journal stud. It is here to be noted that the parts are so proportioned that the outer perimetral wall 38 of the spring recess of the die wheel registers with the outer or left-hand face of the slotted opening 49 of the carrier as shown in FIGURE 10. To this end such slotted opening 49 preferably is L-shaped as well shown in various of the figures, so that when the end portion 48 of the spring is shifted axially into such slotted opening by bringing the die wheel and the proximate face of the carrier close together, such die wheel may then be shifted slightly towards the right (when viewed as in FIGURES 1, 3, 5, 9 and 10) to bring the perimetral wall 38 of the spring recess of the die wheel into alignment with the rightwardly extending portion of such L-shaped recess 49, as evident particularly in FIGURE 10.

As shown in FIGURES 10, 11, 12, 14, 15 and 16, the the projecting end portion of such spring element is formed into a loop 48^a, and when the parts are assembled as explained above such loop lies in a plane parallel

to the axis of rotation, and thus normal to the face of the die wheel. The inner end portion of the L-shaped slotted opening 49 is enlarged and of circular form concentric with the opening 50, and in effect constitutes a portion of such opening 50. Thus, by properly manipulating the die wheel with respect to the carrier while these parts are brought together it is possible to cause the looped end portion of the spring element to move into the slotted opening 49 as the faces of the die wheel and the carrier come closer together, and then, as these faces come into contact, or close to such contact, the die wheel and the carrier may be shifted with respect to each other with a sliding action, to bring the die wheel and the stud opening (for the stud 23 or 27, as the case may be) into register so that the stud may be shifted endwise through the die wheel and the carrier to complete the assembly of such elements into journalling relationship with respect to each other.

Prior to the foregoing operation an anvil stud 51 was set into that portion of the opening 50 which extends into registry and communication with the journal opening through which the stud 23 or 27, as the case may be, extends. Such anvil stud 51 is provided with an enlarged head 52 which provides an inwardly facing shoulder 53, the size of the opening 50 being reduced to receive the smaller end portion 54 of such anvil stud when the parts are assembled; but it is noted that such shoulder does not engage the corresponding shoulder of the opening 50 prior to firm engagement of the inner end of such reduced portion 54 with the "flat" of the journal stud. Thus, by forcing such anvil stud inwardly its inner end is brought into strong locking engagement with such "flat," and the journal stud is strongly retained against shift. Since the head portion 52 of such anvil stud is of size to be moved through the opening 50 it is possible to insert such anvil stud through such opening 50 and into place next to the journal stud prior to setting the projecting end portion of the spring element through the slotted opening 49.

A locking stud 55 is threaded into the opening 50 after the anvil stud and the looped end portion of the spring have been assembled as above explained; and by tightening up such locking stud its inner end 56 is brought firmly against the loop of the spring, thus driving such loop 48^a firmly against the end of the anvil stud, the spring loop serving to transmit pressure from the locking stud to the anvil stud and thus being itself also firmly locked stationary and to the carrier. Conveniently, the inner end of the locking stud may be tapered as shown at 55^a, such tapered portion extending into (and possibly through) the loop of the spring portion.

It is again noted that when the parts have been thus assembled, and when such locking stud has been tightened to its seat with corresponding tightening of the anvil stud against the "flat" of the journal stud, the end portion 48 of the spring element, including the loop 48^a extend straight out from the perimetral wall 38 of the recess or socket so that during such assembly such projecting spring end portion is not intentionally distorted and the anchoring force is transmitted through such straight spring part.

Examination of FIGURE 14 in particular shows the projecting spring portion 48 extending through the slotted opening 49 of the carrier. By forming such slotted opening of proper width (transversely of such slotted opening) the diameter of the spring wire extension will be accommodated without substantial shift of such extending portion 48 either up or down due to torque. Under these conditions it is evident that a shearing force is developed between the spring portion 48 and the edge of the carrier at the point 57 or the point 58. (See FIGURE 14.) Accordingly, in some cases it will be desirable to provide a thin sleeve lining 59 on such projecting end portion such lining being of slightly elastic material such as plastic, and of size to ensure snug fit within such slotted opening 49. Thus undesirable movement between such

projecting spring end and the top or bottom of the slotted opening will be avoided, and the anchored end portion of the spring element will be truly anchored stationary. Such lining may conveniently comprise a small piece of such sheet plastic folded over the spring end portion 48 just prior to seating the spring end into the slotted opening.

In order to facilitate assembly of the parts as already explained I have, in FIGURES 1, 5 and 9, and elsewhere shown the upwardly extending arm 49^a of the slotted opening so that, as the projecting portion of the spring element is moved through said slotted opening such spring portion may also be shifted downwardly into correct position.

Reference has been made to the provision of means to facilitate the acceleration of the die wheel to full surface speed synchronism with respect to the surface speed of the work body when contact is established between such die wheel and such work body. The following further features are now disclosed respecting such provision:

Examination of FIGURES 9, 10 and 11, in particular will show that the characters or symbols 60 which project from the perimeter of such die wheel have their exterior surfaces 60^a of progressively larger radius commencing near the original surface of contact between the die wheel and the work body, so that near the central location of such series of characters or symbols they are of maximum radius, thereafter progressively reducing in radius as the terminal portion of the impression operation is approached. Experience has shown that when such characters are of the full radius at the beginning of contact between them and the work body a severe impact force is produced so that the impressions produced by such early characters or symbols are appreciably deeper than those produced further along the path of impressing travel. Under such conditions the characters thus produced in the central portion of the series are often much lighter than those near the starting and ending portions of the operation, and the quality of the work thus produced is often severely lessened due to such operating condition. I have found that by forming the characters or symbols at or near the beginning and ending phases of the operation of less radial dimension than such characters or symbols in the central portion of the operation, it is still possible to produce impressions in the work body which are of desired depth, but furthermore, the impressions thus produced are of substantially uniform depth over the entire traverse of the operation.

Accordingly, in FIGURES 9, 10 and 11, in particular, I have shown such characters or symbols 60 of progressively different radial dimensions, so that their exterior faces 60^a lie substantially in a surface which is eccentric with respect to the actual axis of rotation of the die wheel. Thus, such axial rotation is produced on the axis 61, whereas the surfaces of the exteriors of the various characters or symbols lie on the eccentric surface defined by the circle 62 drawn about the eccentric center 63. The eccentricity is thus the distance 64 between the two centers. Manifestly other forms of variation of the radii of the successive characters or symbols may be used largely according to the relative hardnesses of the work body and the die wheel characters; but in general the characters or symbols in the central portion of the traverse should be of greater radii than those at and near both terminals of the operation.

In order to improve the wearing quality of the unit by provision for taking care of the impact produced at the terminus of the restoring operation under spring urge, use may be made of a spring unit having its projecting portion 48 of slightly larger diameter than its body portion, so that forces of shear may thus be more readily received without damage to such projecting end portion. In such case the sleeve portion shown at 59 in FIGURE 14 may be considered as representing an enlargement of the projecting portion of the spring element.

The size and hardness of the spring wire used for production of the spring element will depend on various factors, including the mass of the die wheel, its rotative inertia, the acceleration of such wheel required for return thereof to its initial position within the available time, and other factors.

It is noted that in the showing of FIGURE 8 the die characters or symbols are located closer to the far face of such die wheel than to the near face thereof. Such an arrangement will enable production of the desired characters or symbols by impression close to an object or portion of the work body or a portion of the work body support such as the lathe chuck into which such work body may be gripped. It will, course, be understood that the exact form and location of the die characters or symbols on the periphery of the die wheel will depend on various conditions of usage and the form of the work body itself, and that I do not intend to limit myself to such details as the exact axial location of the die characters or symbols on the peripheral surface of the die wheel, except as I may do so in the claims to follow.

The following comments are pertinent respecting certain operations possible with this improved marking die:

Examination of FIGURES 3 and 4 shows that the bifurcation 25 of the carrier is of less thickness than the bifurcation 24. Accordingly, it is possible to set the marking die to a position of engagement with the work body close to any obstruction which might limit the closeness to which the indicia or symbols could be produced on such work body.

In the case of the embodiment shown in FIGURES 5, 6, 7 and 8 the indicia or symbols can be produced even closer to an obstruction or limiting feature such as the enlargement 65. This benefit is made possible by two features of such embodiment; first, in this embodiment the marking die wheel is supported by the stud 27 without the presence of any outboard bearing such as the bifurcation 25, so that the face of such die wheel may be brought close to the projection 65 as shown in FIGURE 8. Furthermore, in the embodiment shown in FIGURES 5, 6, 7 and 8 the impressing indicia or symbols are formed closer to the outer face of the die wheel than to its inner face, thus making it possible to bring such indicia or symbols very close to a limiting location or element, such as said projection 65. This relation is well shown by comparison of FIGURES 7 and 8. The latter figure in particular shows that the indicia or symbols 60^b may be brought very close to such limiting feature 65.

Manifestly the carriers 20 and/or 26 may be supported in any convenient manner with respect to the work body, and in manner permitting such carriers to be shifted back and forth with respect to the work body as shown by the arrows 67 in FIGURE 1. Thus, for example, I have shown the opening 66 through the carrier 20 of FIGURES 1, 2, 3 and 4, through which opening a bolt or other element may be extended to secure such carrier to a suitable movable holder. In the embodiment of FIGURES 5, 6, 7 and 8 the bar carrier 26 may be clamped into any suitable form of movable holder enabling the performance of the necessary back and forth movements of such carrier during the successive die marking operations.

Examination of FIGURES 1 and 10, in particular, shows that when the locking stud 55 is screwed home to its position of drive against the loop 48^a of the anchored end of the spring element, such stud extends into that portion of the opening 50 which lies to the right of the slotted opening 49, thus sealing the opening leading to the anchored end of the spring unit. Thus, when assembly has been completed a substantially sealed enclosure is provided for the spring element and related parts, preventing ingress of dust, grease, and other foreign materials. This is important in order to ensure accurate and correct functioning of the device under the conditions of

accuracy and time limitations which must be adhered to. The close but movement free contact of the face of the die wheel with the surface of the slotted opening (FIGURES 1, 2, 3 and 4) or with the face of the bar carrier (FIGURES 5, 6, 7 and 8), ensures good seal of the spring element socket 37 against ingress of foreign material and also prevents possible shift of the outer or near convolution of the spring from such socket, thus ensuring accurate and dependable running of the spring element in service.

During the impressing operation, with die wheel rotation in the directions of the clockwise arrows in various figures, the spring is being wound, producing increased tension in such spring, with corresponding increase of pull on the spring end element 48-48^a. Such spring element is designed to accommodate such amount of wind due to angular movement of the die wheel as is necessary to ensure impression of all of the characters or symbols carried by such die wheel. Usually such angular movement will not exceed substantially 180 degrees, although the exact angular movement needed will, of course be determined on the specifications to which the unit is designed and built. Such an amount of angular movement is well accommodated within a design incorporating generally not more than two spring element convolutions.

In case of winding movement exceeding that amount for which the unit has been designed it is evident that more inward draw of the spring convolutions will be produced than was intended in such design. Some such excess winding is usually accommodated without damage to the spring or other parts; but winding operation in excess of such over-wind may and in some cases will damage the spring itself either by producing a fixed distortion of the spring element or even breakage thereof. It is evident that in case the die wheel should be brought into engagement with a work body rotating or moving at large speed, the die wheel will be brought to correspondingly large rotational speed. At the instant of disengagement of the final character or symbol 34 from the work body and engagement of the blind section 36 with such work body, the rotational speed of the die wheel may be so large as to cause some over-run of such die wheel, with damage to the spring element. In order to prevent such over-run from any cause, including such high rotational speed of impressing operation, I have provided, in FIGURE 9, the radial projection 68 carried by such die wheel close to the starting blind section 35, but in advance thereof, and the cross pin 69 across the slotted opening 21, both such projection 68 and such cross pin 69 being located at or extending to a radius from the axis of die wheel rotation greater than the largest radius of any of the perimetral surfaces of the die elements 60. Furthermore, such radial pin and such cross pin are so located as to allow for at least sufficient rotation of the die element wheel to enable impressing to be produced by all of the characters or symbols. Similar limiting arrangements may also be provided in the embodiment shown in FIGURES 5, 6, 7 and 8, and others.

Such means for producing limitation of the winding rotation of the die wheel is given by way of illustration only, since manifestly various other arrangements may be incorporated in the unit as may suggest themselves to the designer and builder of such unit. Accordingly, I do not intend to limit myself to such illustrated embodiment of rotation limiting means, except as I may limit myself in the claims to follow.

I claim:

1. A marking die including in combination a die wheel carrier including a journal stud, a disk shaped rotary die wheel journaled on said stud, the carrier and the die wheel having proximate opposing companion planar die wheel and carrier surfaces normal to an axis of rotation of the die wheel on the stud, means to retain the die wheel and the carrier together in substantially

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facial contact, a series of die characters extending outwardly from the periphery of the die wheel around an arc of said wheel, there being an annular spring receiving recess extending into the body of said die wheel from the die wheel planar surface aforesaid, said recess being substantially co-axial with the axis of die wheel rotation and having an outer substantially circular cylindrical spring expansion limiting wall extending axially of the die wheel from the die wheel planar surface, a helical spring seated within said annular recess, means to secure one end of said spring to the floor of the annular recess, the other end of the spring extending outwardly from the annular recess in axial direction through the planar surfaces, and means to anchor said outwardly extending portion to the carrier, the spring being biased and pre-loaded when its convolutions are in expanded unwound pre-loaded location and in engagement with the expansion limiting wall with the die wheel in a zero starting position with respect to the carrier.

2. A marking die as defined in claim 1, wherein the carrier is provided with a transverse spring end element receiving opening extending from the planar carrier surface and normal to said surface at a location in substantial alignment with the outer expansion limiting wall of the die wheel recess, and wherein the spring end element extends directly into said transverse receiving opening, together with means to lock the spring end element within said transverse opening.

3. A marking die as defined in claim 2, wherein the spring end element includes an opening extending in direction substantially radial with respect to the axis of die

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wheel rotation, and wherein the means to anchor the outwardly extending portion of the spring comprises a locking stud carried by the carrier and movable radially in the carrier with respect to the journal stud through said opening of the outwardly extending portion of the spring.

4. A marking die as defined in claim 1, wherein the stud is seated into an opening of the carrier, and wherein the carrier is provided with a transverse spring end receiving opening extending from the planar carrier surface aforesaid at a location in substantial alignment with the outer substantially circular spring expansion limiting wall of the die wheel recess aforesaid, together with means to lock the spring end element within said transverse opening and to lock the journal stud against movement with respect to the carrier, comprising an anvil stud and an opening of the carrier wherein said anvil stud is movable into engagement with the face of the journal stud which opening of the carrier extends transversely of the transverse spring end element receiving opening, and a locking stud in the carrier movable in direction to force the spring end element against the anvil stud while said anvil stud is in engagement with the journal stud.

References Cited in the file of this patent

UNITED STATES PATENTS

401,355	Dodson	Apr. 16, 1889
979,297	Henrich	Dec. 20, 1910
2,417,865	Douglass	Mar. 25, 1947
2,610,576	Norris	Sept. 16, 1952
2,676,534	Norris et al.	Apr. 27, 1954