March 29, 1955 C. D. TAYLOR 2,704,902

MACHINE FOR AND METHOD OF MARKING METAL ARTICLES

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3 Sheets-Sheet 1

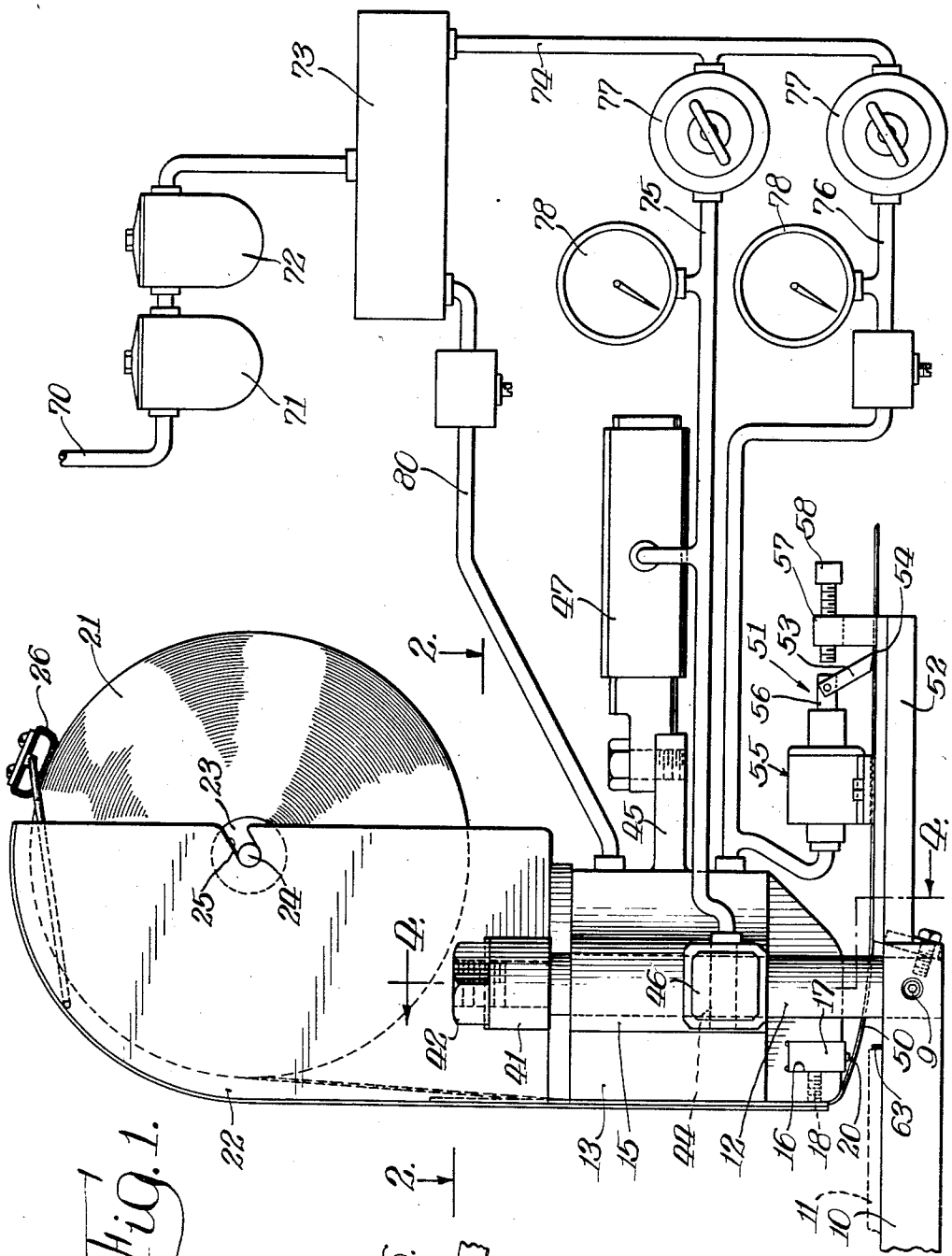

Fig. 1.

Fig. 6.

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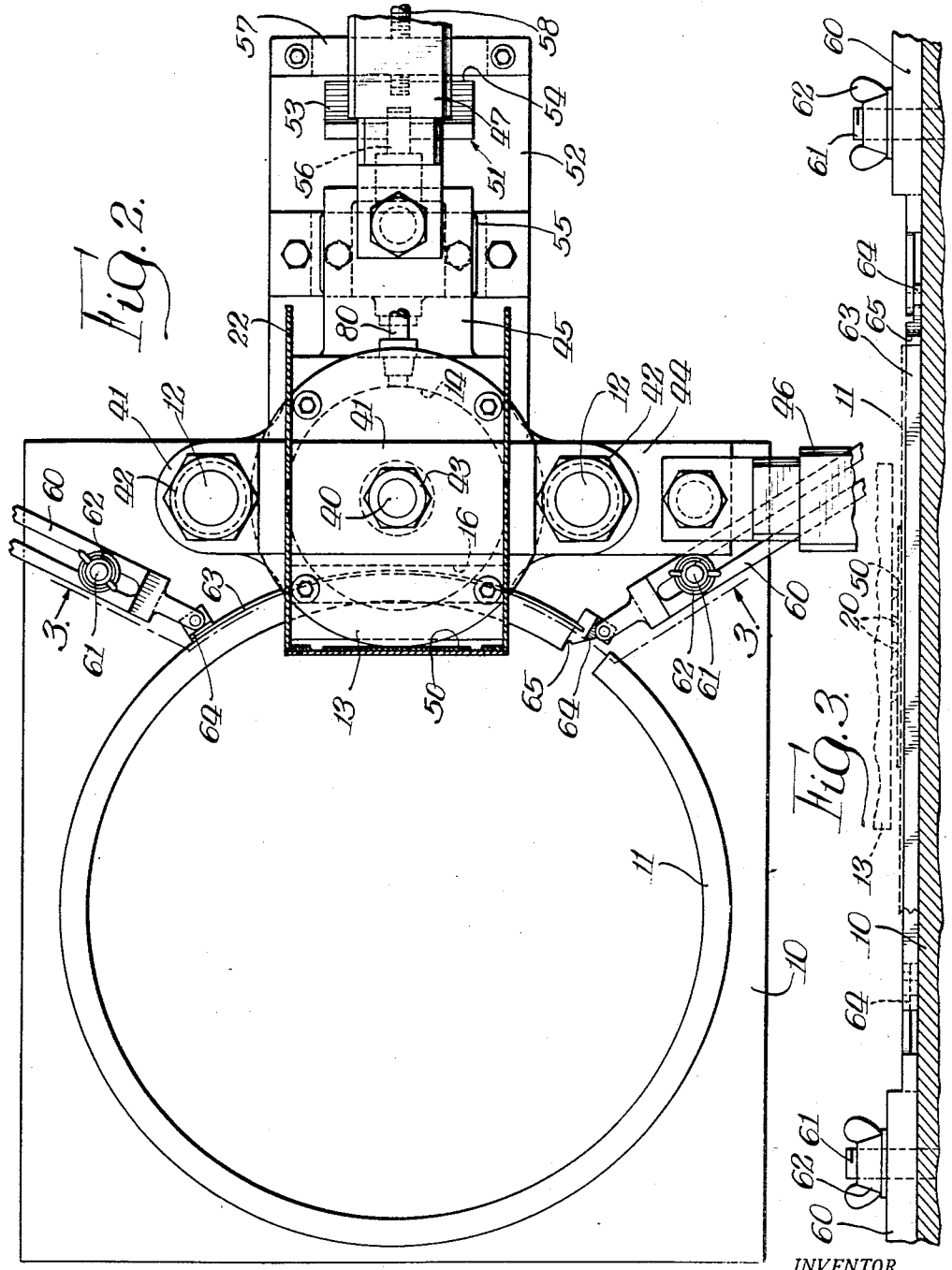

Fig. 2.

Fig. 3.

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Fig. 4.

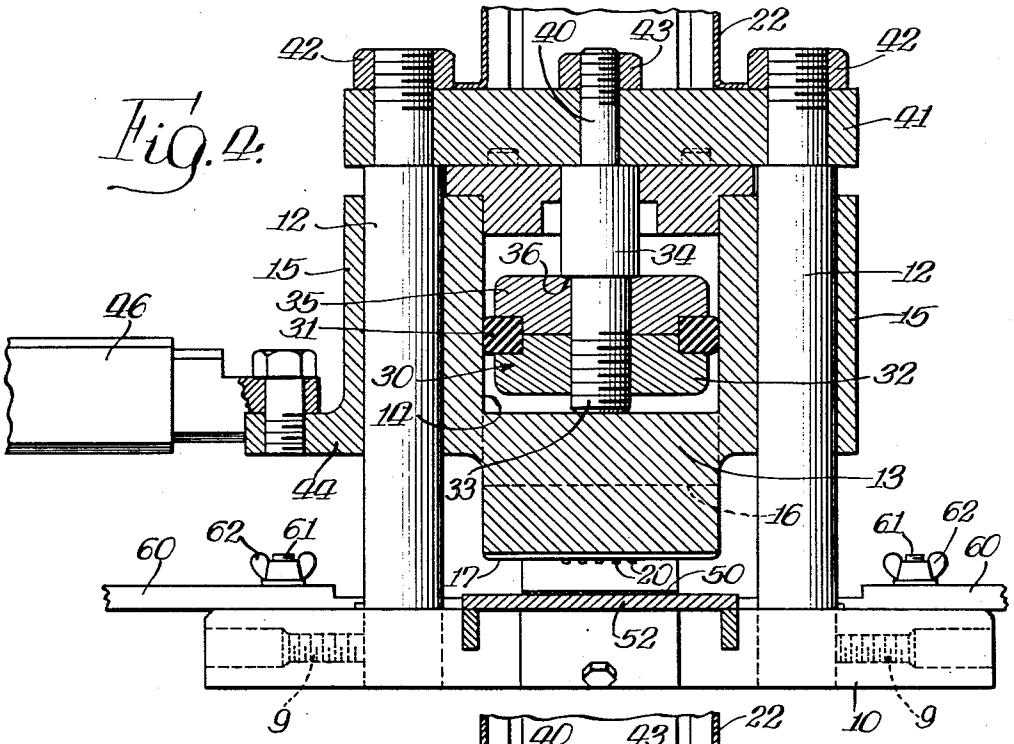
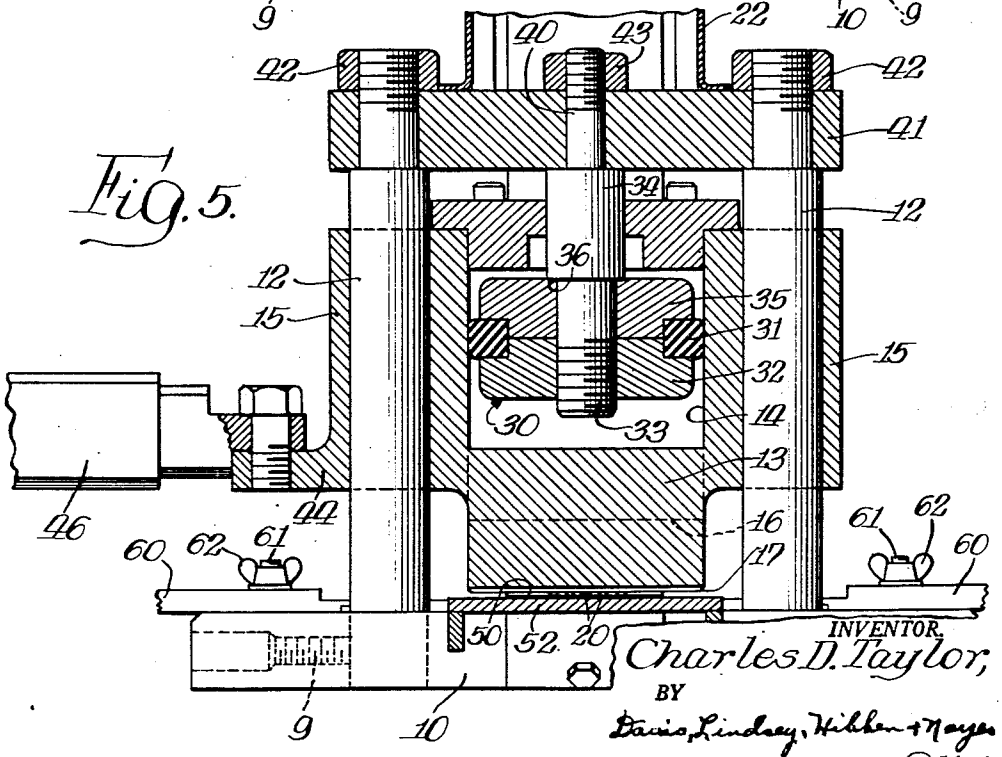


Fig. 5.



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MACHINE FOR AND METHOD OF MARKING METAL ARTICLES

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Application August 18, 1951, Serial No. 242,573

11 Claims. (Cl. 41—7)

The invention relates generally to marking metal articles and more particularly to marking metal articles having a coated surface such as a blued surface, tin-plated, or cadmium-plated surfaces, or surfaces having coatings known in the trade as Ferrox (a coating of black magnetic oxide, i. e. ferroso-ferric oxide) or Parco-Lubrite (a phosphate coating).

The general object of the invention is to provide a novel machine for and method of marking metal articles having coated surfaces of the foregoing character by which a relatively permanent marking is provided on the article without marring the surface thereof.

Another object is to provide a novel machine for and method of marking such coated metal articles by which a marking capable of withstanding oil is obtained, so that oil encountered in machining operations will not obliterate the marking, nor will oil on the work pieces at the time of marking interfere with the marking.

A further object is to provide a novel machine for and method of marking such coated metal articles by which the marking may be rapidly applied to the article.

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

Fig. 1 is a side elevational view of a machine embodying the features of the invention and showing the air connections diagrammatically;

Fig. 2 is a plan view of the machine, partially in section taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary sectional view taken on the line 4—4 of Fig. 1 and showing the marking means in its raised or inoperative position;

Fig. 5 is a view similar to Fig. 4, but showing the marking means in operative position; and

Fig. 6 is a fragmentary view of an article showing, by way of example, the character of marking that may be placed thereon.

Difficulty has been experienced heretofore in placing a marking on a finished surface of a metal article, which was permanent and which did not mar the surface in any way. Stamped markings can, of course, be placed on metal surfaces, but they cause indentations in the surface and thus mar the surface in such a way that for some purposes such markings cannot be employed. Inks of different types have been used in such cases, but the surface has to be absolutely clean before applying the ink. Oil on the surface, such as remains after some machining operations, prevents marking in this manner. Moreover, the ink is readily wiped off and obliterated and will not withstand oil encountered in subsequent machine operations.

The present method provides a substantially permanent marking on coated metal surfaces without marring the surface. Thus, the present invention is applicable for marking surfaces which have been blued, tin-plated, cadmium-plated, or which have been given coatings known in the trade as Ferrox (a coating of black magnetic oxide, i. e. ferroso-ferric oxide) or Parco-Lubrite (a phosphate coating). The invention, however, is not limited to these specific coatings, but can be used with any other similar types of coatings. There are, of course, numerous types of articles where marking of this character is desirable. One instance is in the case of piston rings such as are employed in internal combustion engines or in other piston and cylinder devices.

The invention comprises generally a method of and machine for producing markings of this character by impregnating the coated surfaces of such metal articles with a relatively soft metal in areas defining the markings desired. Thus, letters, numerals, or other characters may be marked on an article by impregnating a soft metal into the coating in the form of such letters, numerals, or other characters. To effect such impregnation of the coatings, a strip or piece of foil of such soft metal is placed upon the surface to be marked, and a tool or type bar having characters on its face of substantially the size and shape of the marking is pressed against the foil to clamp the latter between the tool and the work. The tool is then given a vibratory rubbing movement parallel to the surface of the work. Such vibratory movement is preferably circular, and as a result thereof, some of the metal from the foil is forced into the coating to form a marking substantially corresponding in size and shape to the characters on such tools. The various lines forming such characters, of course, will be slightly broader than the width of such lines on the tool, due to the vibratory motion of the tool, but such vibratory motion is small compared to the width of the lines of the characters on the tool so that such lines are not greatly enlarged or distorted by the increase in width.

The marking thus obtained on a coated surface of this character is substantially permanent in character and at least will remain on the article so long as there is any coating left in the area of marking. Such marking is not in any way affected by oil during subsequent machining operations and may be applied to an article even when the latter is covered with a film of oil from previous machining operations. Furthermore, the marking may be rapidly performed and does not require any time subsequent to its application to dry.

The preferred form of the machine for applying such marking, shown in the drawings, comprises a base or work support **10** which, in this instance, comprises a flat block of metal adapted to rest on a bench. The upper surface of the work support **10** is adapted to receive the work which is here illustrated as being a piston ring **11** lying flatwise thereon. Extending upwardly above the rear portion of the base **10** is the marking means and the means for supporting the soft metal foil in position for application to the work piece. Preferably, the marking means and the foil supporting means are carried by a pair of upstanding posts **12** located at the rear of the base **10** and having their lower ends secured therein as by set screws **9**. The posts **12** are laterally spaced from each other and slidably support a head or tool support **13**. The tool support **13** is adapted to be moved toward and from the work by aid under pressure and, to this end, the tool support comprises a cylinder **14** having a pair of tubular portions **15** at its sides, through which the posts **12** extend. At its lower end, the tool support is provided with a slot **16** in which a type bar or tool **17** is secured as by a set screw **18**. The tool or type bar **17** extends slightly below the lower end of the tool support **13** and has on its lower face the desired characters indicated at **20**. These characters **20** project from the lower face of the tool bar **17** and are of substantially the same size and shape as the marking desired on the work pieces, although the lines of which the characters may be formed are slightly narrower than the lines of the ultimate marking.

The soft metal foil is preferably supplied in the form of a roll **21** supported and partially enclosed by a sheet metal cover structure **22**. In the present instance, the coil or roll of foil is shown as provided with a core **23** through which an axle **24** extends, the latter being mounted in slots **25** in the side walls of the supporting structure **22**. The latter is mounted on the upper end of the tool support **13**. The supporting structure **22** is also preferably provided with a wiper **26** which bears against the surface of the metal foil as it is drawn off the roll so that all foreign matter is wiped off the metal foil before it is applied to the work. The free end of the foil extends downwardly from the front of the roll and is drawn rearwardly under the tool **17**, so that it will be pressed against the work when the tool is moved into operative position.

To move the tool toward and from the work, air operated means is employed as heretofore mentioned. In the present instance, the air-operated means comprises the cylinder **14** co-operating with a piston **30** carrying packing **31** engaging the walls of the cylinder **14**. The piston **30** is of two-part construction comprising a lower member **32** threaded on the lower end **33** of a piston rod **34**, the other member of the piston, indicated at **35**, being clamped between the member **32** and a shoulder **36** formed on the piston rod **34**. In this instance, the piston remains stationary during operation of the device, while the cylinder moves, and the piston rod **34** has a reduced upper end **40** extending through a bridge **41** spanning the space between the post **12** and secured to the posts as by nuts **42**. The reduced upper end **40** of the piston rod **34** is secured to the bridge **41** as by means of a nut **43**.

In operation, when air under pressure is admitted to the cylinder **14** below the piston **30**, the tool support **17** will be moved downwardly to press the type bar or tool as well as the metal foil against the work. When air under pressure is admitted to the upper end of the cylinder **14** above the piston **30** and the lower end of the cylinder is connected to exhaust, the work support **13** will be moved upwardly. Thus, the tool may be moved toward the work and from the work with the foil interposed between the tool and the work.

As heretofore mentioned, when the tool and the foil are pressed against the work, the tool is also vibrated in a direction parallel to the surface of the work which is to be marked. This produces a rubbing action while the foil is pressed against the work and results in impregnating the coated surface of the article with metal from the foil. The vibratory motion imparted to the tool is preferably generally circular in character and to accomplish this result, a pair of vibrators are secured to the tool support **13** to produce a resultant circular movement. As shown in the drawings, the tool support **13** is provided at one side with a laterally extending lug **44** and at its rear with another lug **45**. Secured to the lugs **44** and **45** are vibrators **46** and **47**. In this instance, the vibrators **46** and **47** are of the air-operated type and tend to produce a vibratory movement longitudinally thereof. Thus, they impart a vibratory motion in two directions to the tool support **13**, the posts **12** loosely fitting in the tubular portions **15** of tool support so that the latter is free to vibrate. Since the vibrators are positioned at right angles to each other and are operated simultaneously, the resultant motion given to the tool support is circular in character, so that the tool **17** is given a circular rubbing movement parallel to the surface on the work piece to be marked.

It has been found that, after each marking operation, the particular portion of the foil applied to the work piece is unsuitable for further marking, although very little of the metal from the foil has been impregnated into the surface of the article. The rubbing action of the tool, while it does not puncture or perforate the metal foil, apparently causes a hardening of the foil, thereby rendering it unsuitable for further use. Consequently, the foil is shifted relative to the work, so that a new portion of foil is available for the ring marking operation.

As heretofore mentioned, the free end of the foil from the roll **21** extends downwardly over the front of the work support **13** and thence rearwardly under the tool **17**, as indicated at **50** in Fig. 1. To feed the foil, a feeding device indicated generally at **51** is provided. Such feeding device, in the present instance, is illustrated as comprising a bracket **52** secured to and extending rearwardly from the base or work support **10**. The free end **50** of the foil extends rearwardly over the base **52**, and over it is mounted a movable tongue **53** having a sharp lower edge **54** adapted to engage the foil as the latter lies flatwise on the bracket **52**. The tongue **53** is adapted to be moved rearwardly with the sharp edge **54** in engagement with the foil thereby pushing the foil rearwardly along the bracket **52**. To move the tongue **53** in this manner, an air operated piston and cylinder device indicated at **55** is provided. The piston of the device **55** has a piston rod **56** upon the free end of which the tongue **53** is pivotally mounted. Thus, when air is admitted to the device **55**, the piston rod **56** moves rearwardly and the sharp edge **54** of the tongue **53** tends to dig into the foil and shift it rearwardly along the bracket **52**. When the air pressure is released from the device **55**, the piston rod **56** is retracted by a spring (not shown) and the tongue **53** rides freely over the foil. To limit the extent to which the foil is fed on each stroke of the piston rod **56**, a bridge **57** is mounted on the outer or rear end of the bracket **52**, so that the foil can pass thereunder, and a stop screw **58** is threaded in the bridge **57** to provide an adjustable abutment limiting rearward movement of the piston rod **56**.

The base **10** is preferably provided with a work locating means so that the marking may be placed in the same location on each piece of work. In the present instance where piston rings are being marked, the work locating means comprises a pair of supports **60** of elongated form, adapted to lie flatwise on the base **10** and provided with longitudinal slots through which screws **61** provided with wing nuts **62** extend. The supports **60** thus may be clamped to the base and are adjustable both longitudinally and angularly about the screws **61**, so that the work positioning means may be adapted for rings of different diameters. Extending between the supports **60** is a flexible metal band **63** which is held in an arcuate form by the supports **60**. The band **63** at each of its ends is provided with an attaching member **64** by which the band is secured to the supports **60**. Since it is desirable to place the marking on each piston ring at a set distance from one end of the ring formed by the gap therein, one of the attaching members **64** is provided with a finger portion **65** adapted to extend into the gap of the ring. Thus, when a ring is being put into place for marking, it is placed in abutment with the band **63** and one end of the ring engages the finger portion **65**.

As heretofore mentioned, the means for moving the work support **13**, as well as the vibrators **46** and **47** and the foil feeding device **51**, are all operated by air under pressure. The supply of such air to these various devices thus may be co-ordinated into a single air supply system illustrated diagrammatically as a part of Fig. 1. As shown in this figure, air under pressure is supplied from a suitable source through a pipe **70** and it then is preferably passed through a filter **71** and a lubricator **72**. From there, the air passes to a three-way valve **73** which may be of the type adapted to be actuated by foot. For operating the various parts of the machine, the valve **73** is connected by a pipe **74** to two branch lines **75** and **76**. In each of these branch lines is a pressure regulator **77** and a gauge **78**. The branch line **75** is connected to operate the two vibrators **46** and **47** while the branch line **76** is connected to supply air to the lower end of the cylinder **14** for moving the tool **17** downwardly into engagement with the foil. The branch line **76** also supplies air to the piston and cylinder device **55** for feeding the foil rearwardly to bring a new portion thereof under the tool **17**. Since the vibrators **46** and **47**, the lower part of the cylinder **14**, and the piston and cylinder device **55** for feeding the foil all are connected with the line **74**, the valve **73** when it connects the source with the line **74** thus causes the tool to be moved downwardly, the foil to be fed through one step and the two vibrators to operate. Marking of the work piece is thereby effected.

The valve **73** is also adapted to be shifted to a position where the line **74** is cut off from the source **70** and a line **80** is connected thereto. The line **80** leads to the upper part of the cylinder **14** and when air under pressure is supplied thereto, the tool support **13** will be raised to move the tool **17** away from the work. The valve **73** may also be moved to an intermediate position which it normally assumes, in which position neither the line **74** nor the line **80** are connected to the source **70**.

As an example of the size of the marking contemplated, a marking which has been found suitable for piston rings involves the use of characters in which the various component lines have a width on the order of .008 of an inch. The extent of vibration utilized with lines of this width was .002 to .0025 of an inch. Thus, the width of the component lines of the marking would be on the order of .010 of an inch, so that the characters on the tool have substantially the same size and shape as the marking. The foil used was .002 of an inch in thickness and was aluminum of the grade known in the trade as full-annealed. The invention, however, is obviously not limited to these particular dimensions, nor to use of this particular metal for the foil. Other soft metals such as copper could be used, and characters of different widths of lines could of course be formed. It is obvious, too, that with markings composed of lines of greater width, a

greater range of vibration may be employed without unduly distorting the characters.

From the foregoing, it is apparent that I have provided a novel method of and machine for marking metal articles having coated surfaces of the character described. Since the material from the foil is impregnated into the coating on the metal surface, a relative permanent marking is thereby obtained. Moreover, there is no marring of the material surface since insufficient pressure is applied to the tool to cause any indentation on the surface of the work piece. In the case of piston rings, it was found that a downward pressure on the tool anywhere from ten to forty pounds, depending upon the extent of the marking, was sufficient. It therefore appears that the rubbing movement effected by the vibrators causes the impregnation of the metal of the foil into the surface. The pressure apparently merely holds the foil in close contact with the surface of the article. Oil encountered in machining operations does not affect the marking, and it has been found that, even if a film of oil is on the article at the time of marking, it does not interfere with proper impregnation of the foil into the surface.

I claim:

1. The method of marking a surface of a metal article having an impregnatable surface coating, comprising placing a piece of soft metal foil on said surface, pressing a tool having a foil engaging face provided with characters of substantially the size and shape of the marking against the exposed face of said foil with a pressure which is insufficient to indent said surface, the foil being softer than said coating and said tool, and vibrating said tool in a direction parallel to said surface while the tool is held under such pressure whereby the metal surface is provided with the marking solely by impregnation of said coating with the foil and without indentation or covering of said surface.

2. The method of claim 1 further characterized in that said tool is vibrated with a generally circular motion parallel to said surface.

3. The method of claim 1 further characterized in that said tool is vibrated in two directions perpendicular to each other and parallel to said surface.

4. A marking machine for marking a surface of a metal article having an impregnatable surface coating, comprising a work support, a tool having characters on its face of substantially the size and shape of the marking, means for feeding a strip of soft metal foil between the tool and the work, guide means mounted on said work support, a tool support carrying said tool and slidably supported by said guide means for movement toward and from said work support, means for moving said tool support toward the work to clamp the foil between the tool and the work, and vibrating means mounted on said tool support for vibrating the tool parallel to the work.

5. The apparatus of claim 4 further characterized in that said machine is also provided with means for supporting a coil of soft metal foil adjacent said tool with the foil being adapted to extend between the tool and the work, and means is also provided for intermittently feeding said foil to place a new portion of foil between the tool and the work each time the tool is moved toward the work.

6. A marking machine for marking a surface of a metal article having an impregnatable surface coating, comprising a work support, a tool having characters on its face of substantially the size and shape of the marking, means for feeding a strip of soft metal foil between the tool and the work, a pair of posts mounted on said work support, a tool support carrying said tool and slidably mounted on said posts and including pneumatic piston and cylinder means for moving the tool support toward the work to clamp to foil between the tool and the work, and vibrating means mounted on said tool support for vibrating the tool parallel to the work.

7. A marking machine for marking a surface of a metal article having an impregnatable surface coating, comprising a work support, a tool having characters on its face of substantially the size and shape of the marking, means for feeding a strip of soft metal foil between the tool and the work, a pair of posts mouted on said work support, an air cylinder slidably mounted on said posts and carrying said tool and movable toward the work to clamp the foil between the tool and the work, a piston mounted in said cylinder and rigidly supported by said posts, and vibrating means mounted on said cylinder for vibrating the tool parallel to the work.

8. A marking machine for marking a surface of a metal article having an impregnatable surface coating, comprising a work support, a tool having characters on its face of substantially the size and shape of the marking, means for feeding a strip of soft metal foil between the tool and the work, a pair of laterally spaced posts mounted on said work support, an air cylinder located between said posts and having a pair of sleeve portions slidably mounted on said posts, said cylinder carrying said tool and being movable toward the work support to clamp the foil between the tool and the work, a bridge rigidly connecting the upper ends of said posts, a piston mounted in said cylinder and having a piston rod rigidly connected to said bridge, and vibrating means mounted on said cylinder for vibrating the tool parallel to the work.

9. A marking machine for marking a surface of a metal article having an impregnatable surface coating, comprising a work support, a tool having characters on its face of substantially the size and shape of the marking, means for supporting a coil of soft metal foil adjacent said tool with the foil extending between the tool and the work, air-operated means for moving the tool toward and from the work, air-operated means for intermittently feeding said foil to place a new portion of foil between the tool and the work, air-operated vibrating means for vibrating the tool parallel to the work, a source of air under pressure, and valve means arranged when in one position to connect said source with said tool moving means to move the tool toward the work and with said foil feeding means to place a new portion of foil between the tool and the work and with said vibrating means, and when in another position to move the tool away from the work.

10. A marking machine for marking a surface of a metal article having an impregnatable surface coating, comprising a work support, a tool having characters on its face of substantially the size and shape of the marking, means for feeding a strip of soft metal foil between the tool and the work, a pair of posts mounted on said work support, a tool support carrying said tool and slidably mounted on said posts and including means for moving the tool support toward the work to clamp the foil against the work by pressing the tool thereagainst, and means for vibrating the tool support parallel to the work and transversely of said posts, said tool support loosely engaging said posts to permit of limited vibration relative thereto.

11. A marking machine for marking a surface of a metal article having an impregnatable surface coating, comprising a work support, a tool having characters on its face of substantially the size and shape of the marking, means for feeding a strip of soft metal foil between the tool and the work, a pair of posts mounted on said work support, a tool support carrying said tool and slidably mounted on said posts and including means for moving the tool support toward the work to clamp the foil against the work by pressing the tool thereagainst, and means for effecting limited vibration of the tool support parallel to the work and transversely of said posts, said posts having a loose fit in at least one of said supports whereby to permit said limited vibration of the tool support.

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