

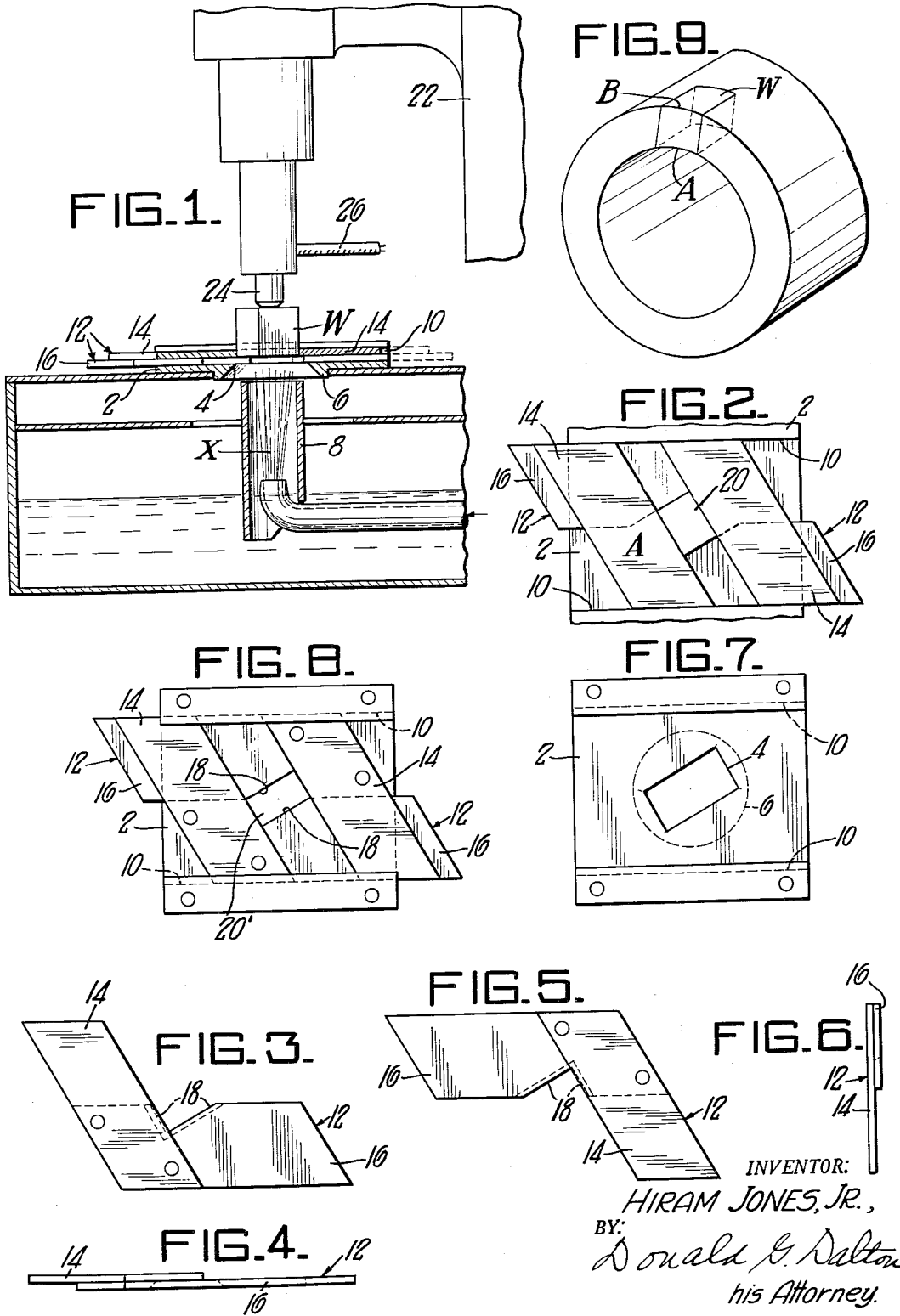
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ADJUSTABLE MASKING SHIELD FOR ELECTRO-POLISHER

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1

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ADJUSTABLE MASKING SHIELD FOR ELECTRO-POLISHER

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1 Claim. (Cl. 204—279)

The present invention relates to an adjustable masking shield for exposing uniform surface areas of various size metal specimens for electro-polishing.

A process frequently used for electro-polishing a metal specimen in preparation for metallographic examination consists of passing an electric current between the specimen and a solution of perchloric acid in contact with the specimen. This process provides a well polished surface in considerably less time than conventional mechanical polishing methods. In this process the amperage and voltage of the current used is varied according to the size of the area to be polished while the time is usually kept constant. For example, I have obtained good results in polishing a surface area of .0767 square inch of a specimen by using .6 ampere at 10–20 volts, while I have found 1.6 amperes at 20–30 volts necessary for polishing an area of .1964 square inch, the time remaining at approximately 20 seconds in each case.

When polishing a number of specimens of various sizes, measurement of the area to be polished and calculation of the current necessary therefor takes up considerable time in comparison with the actual polishing interval of approximately a half a minute. More uniform results are obtained and much time is saved when the surface area to be polished on each specimen is kept substantially the same so that a uniform exposure time and a constant amperage and voltage may be used for a large number of specimens. I have found the latter arrangement to be particularly advantageous in the processing of samples of various sized steel tubes where it is necessary to study the microstructure of a cross section of the tube from the inside to the outside wall.

Where it is desired to examine the microstructure of a tubular product, the specimen is obtained by cutting out a rectangular section of the tube wall—the long length of the rectangle being parallel with the longitudinal axis of the pipe. The end of this rectangular specimen is polished so that the grain structure of the tube cross section from inner to outer wall may be studied.

Several commercial electro-polishing machines are currently available for preparing metallurgical samples and essentially these devices operate by passing an electrical current of predetermined amperage and voltage through the sample while the surface desired to be polished is held in contact with a suitable etchant. Masking shields are usually provided with these machines for defining a specific circular area of the surface to be polished. In general, a circular area is not suitable for use on tubular pipe specimens where it is desired to show the full section of the tube wall from the inside to the outside surface of a pipe. For this purpose rectangular areas are preferable. In conventional electro-polishing of metallurgical specimens, the exposed specimen surface to be polished is positioned over an acid port which is connected with an acid supply tube. While the electrical current is passing through the specimen, the acid is forced up through the tube and port to contact the surface of the

2

specimen. The fountain effect that is created by the stream of acid contacting the specimen surface produces nonuniform results since at the point of contact the stream of acid is tapered, being most dense at the center and gradually decreasing in density approaching the edge of the acid stream. This frequently resulted in over-polishing at the center of the specimen and under-polishing in the fringe area where a circular mask was used. When using a round shield in electro-polishing tube samples the inner and outer walls would be in the fringe areas.

It is accordingly an object of my invention to provide a masking shield which will expose a substantially rectangular area of surface for electro-polishing.

It is another object of my invention to provide a masking shield which although adapted to receive specimens of varying dimensions, is readily adjustable to expose substantially the same amount of surface area for various sizes of specimens.

It is a further object of my invention to provide an adjustable masking shield which may be readily adjusted to expose two edges and the same surface area of a number of sizes of specimens.

These and other objects will become more apparent after referring to the following specification and attached drawings, in which:

Figure 1 is an elevational view with parts broken away for clarity;

Figure 2 is a top plan view of the device;

Figure 3 is a detail plan of one of the members of the device;

Figure 4 is a side elevation of the member shown in Figure 3;

Figure 5 is a detail plan view of the other member of the device.

Figure 6 is an end elevation of the member shown in Figure 5;

Figure 7 is a detail plan view of the bottom plate of the device;

Figure 8 is a view similar to Figure 2 but showing the device in a different adjusted position for receiving a different size sample; and

Figure 9 illustrates a method of obtaining a specimen from a section of pipe for polishing.

Referring more particularly to the drawings, reference numeral 2 indicates a base sheet which is preferably made of acid-resistant plastic or similar material. The base sheet is provided with a center opening 4 which is substantially rectangular in shape and functions as an acid port. A circular boss 6 is provided around the opening 4 to accommodate the end of an acid tube 8 which fits under the opening 4. The edges of the opening 4 are beveled so as to insure a free flow of acid against the outer edges of an exposed area. If desired the port may be made slightly elliptical by rounding off the corners so as to further insure the free flow of acid. On the side of the sheet 2 opposite the boss 6 a slideway 10 is provided on each of two opposing sides of the sheet. The slideways 10 accommodate a pair of oppositely disposed flat shielding members 12 each of which are made up of angularly disposed legs 14 and 16 which may be made of the same material as the sheet 2. The shielding members 12 are rectilinearly positioned on the sheet within the slideways 10. As seen in Figure 2, one leg 14 of each member 12 overlaps the opposite leg 16 of the other member. The legs 16 of each member are provided with a cut-away portion 18 to form a vertex angle of approximately 90° between the angularly disposed legs 14 and 16 of each member. As best shown in Figure 8, the edge of the cut-out portion 18 along the leg 16 of each member 12 may be inclined at an angle of approximately

3

30 degrees to the slideway in which the leg 16 is fitted. The cut-away portions 18 of each of the members form between them a rectangular aperture 20, the shape of which may be varied by sliding movement of one member relative to the other. The overlapping arrangement of the legs provides a recess for maintaining a specimen in position over the aperture 20. The edges of the cut-away portion 18 on each of the members are beveled in the same manner as the edges of the opening 4 in order to further insure proper contact between the acid and the exposed area of a specimen being polished. The adjusted aperture may be moved within the area of the opening 4 by sliding the members 12 along the slideways 10 while they are in adjusted position. Thus, when a tubing specimen W is placed endwise between the confines of the legs of the members 12, the rectangular aperture 20 will expose the edges A and B of the sample which edges constitute the inner and outer walls of the tube being examined and at the same time a predetermined surface area which will remain substantially the same for other sizes of tubing polished with the same shield. Figure 9 illustrates the manner in which the specimen is cut from the tube wall.

Although I have shown the legs 14 and 16 of each of the shielding members 12 riveted together, each member may be formed in one piece or the legs thereof may be cemented together if desired.

In operation, specimen W is inserted endwise in the shield and the sliding members 12 are positioned up against the specimen with the legs 14 in contact with the edges A and B which are the inner and outer wall of the tube being examined. The device is then placed in the electro-polisher 22 over the acid tube 8 and held in place by means of a hold-down 24 to which a power line 26 is connected. The circular boss 6 aids in locating the shield correctly and after the shield is in place the current, which has been previously set by means of the controls (not shown) of the electro-polisher, is fed to the hold-down by means of line 26 and an acid pump, not shown, is started. The pump provides a slow circulation of the acid X to raise it through tube 8 to contact the exposed surface area of the specimen W. After the predetermined time has elapsed the current is turned off and the specimen is removed ready for washing, drying and metallographical examination.

When placing a specimen from a pipe, having a thinner or thicker wall than that shown in Figure 9, between the legs 14, the members 12 are moved closer or further apart to abut the edges A and B. This changes the peripheral dimensions of the exposed area, i. e., makes two sides shorter and two sides longer, but the sum total of exposed area remains substantially the same so that it is not necessary to change the control settings or time of exposure. For example, in Figure 2 the shielding members 12 are shown adjusted to define an aperture 20 for accommodating a specimen taken from a tube having a wall thickness approximately the same as that shown in Figure 9. In Figure 8, the shielding members 12 are

4

adjusted to form an aperture 20' for accommodating a specimen from a tube having a wall thickness somewhat greater than that shown in Figure 9. It will be noted that although the width and length dimensions of apertures 20 and 20' are different the areas thereof are substantially the same.

It is to be understood that one size of the shield of my invention may be used for specimens of a range of tubing sizes and various size shields may be used for various ranges.

While one embodiment of my invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claim.

I claim:

A masking device adapted to expose a substantially constant rectangular area of a specimen to a liquid etchant which comprises a sheet of material substantially resistant to said etchant having a port therein, a pair of parallel slideways on said sheet adjacent two opposite edges thereof, a pair of oppositely disposed first and second flat shielding members having angularly disposed legs, each member being slidable rectilinearly on said sheet with the first leg of one shielding member in contact with one slideway and the first leg of the other shielding member in contact with the other slideway, the second leg of each shielding member being arranged in overlapping relationship with the first leg of the other shielding member whereby the overlapping legs are adapted to engage opposite sides of a specimen therebetween, the first leg of the first of said shielding members having an edge portion disposed at an oblique angle to the first of said slideways and the second leg of said first shielding member having an edge portion disposed at 90 degrees to said first mentioned edge portion, and the first leg of the second of said shielding members having an edge portion disposed parallel to the said edge portion of the first leg of the first shielding member, the second leg of the second of said shielding members having an edge portion disposed parallel to the said edge portion of the second leg of the first shielding member, said edge portions defining a rectangular opening in communication with said port, the relative dimensions of which opening may be varied by sliding movement of one member relative to the other whereby the area of the specimen exposed through said opening when said overlapping legs are closed thereon is substantially constant.

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