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VACUUM CHUCK JIGS

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FIG. 1

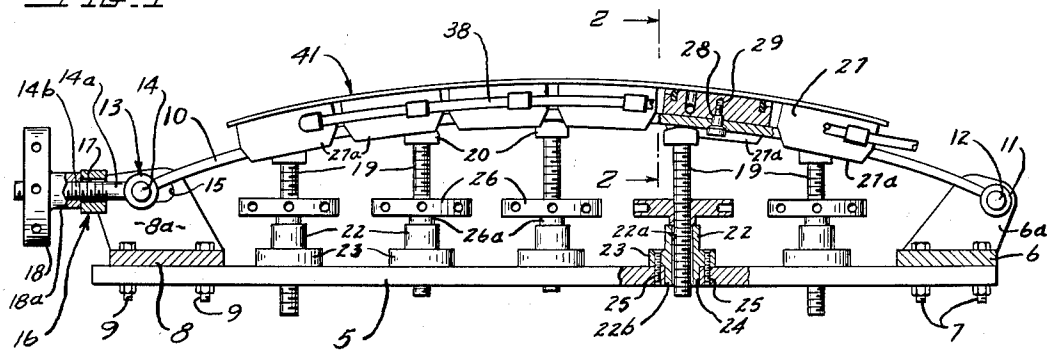


FIG. 2

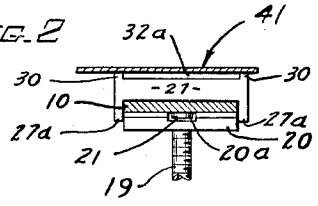
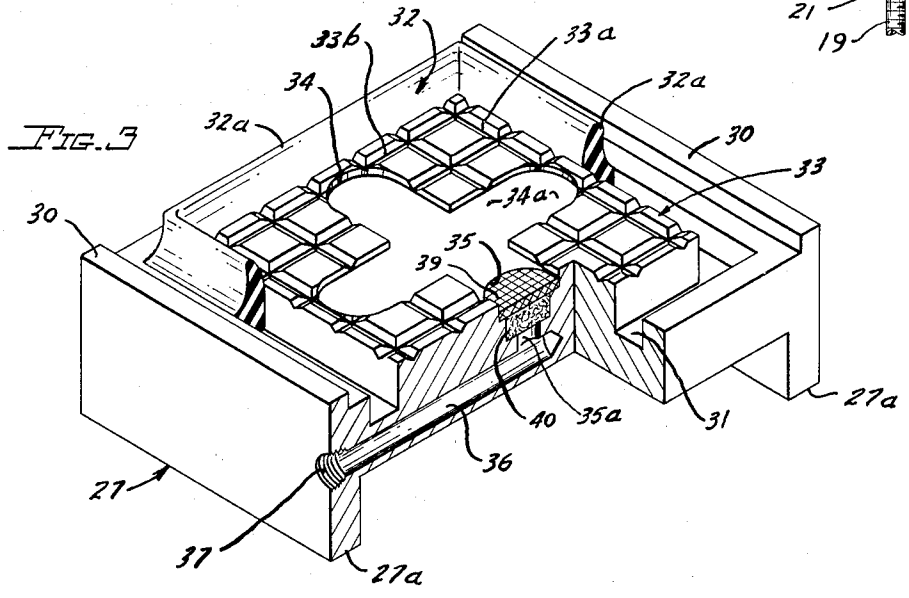


FIG. 3



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VACUUM CHUCK JIGS

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This invention relates to vacuum chuck jigs or the like for fixedly holding items of sheet-form, or other work, while various operations are performed thereon.

Devices of this general character have long been used, for instance, in the plate glass industry for fixedly holding plane glass sheets during polishing operations. Apparatus of this kind, having a permanently and predeterminedly curved work-supporting surface, has also been proposed for use in repetition manufacture where the sanding or polishing of sheet material is required. But the prior art does not provide a device as characterized wherein different predetermined curvatures of a work-holding and sustaining surface can be produced; and it is the primary object of this invention to do so.

Thus the present invention contemplates primarily the provision of a vacuum chuck or jig having a work-holding and sustaining surface which can be readily adjusted and sustained to conform to the surface contour of a particular piece of work, a heavy gauge pre-contoured airplane wing skin for example, so as to securely hold same while its ends are trimmed or milled or other operations performed.

More specifically the invention contemplates in a device of this character the use of a spring metal chuck-carrying plate which is so mounted and acted upon by adjustable means that it can be caused to assume a wide variety of different curvature-incorporating contours according to the contour of the surface of the work to be supported.

It is also an aim of the invention to provide a device for the purpose indicated which is of simple, strong and durable construction, comparatively inexpensive to manufacture and requires no special skill to operate.

The invention also resides in certain novel features of construction, combination and arrangement of the various parts and in modes of operation, as will be understood and appreciated by those versed in the art upon reference to the now preferred example of the invention shown in the accompanying drawing in connection with the detailed description thereof to follow.

In the drawing, wherein the same reference characters designate the same parts throughout the several views—

Figure 1 is a side elevational view partly broken and partly in section of one of the units embodying my invention, it being noted that several of same, in lateral spacement, may be used to support the airplane wing skin or other work;

Figure 2 is a sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a perspective view partly broken and partly in section showing one of the vacuum chucks.

Referring to the drawing by reference characters, numeral 5 indicates a heavy base plate having secured thereto at opposite ends the U-shaped brackets 6, 8, respectively. Boths 7 secure the bracket 6 to the plate 5 while bolts 9 perform the same function as to bracket 8.

These brackets 6, 8 have the spaced upstanding arms

6*a*, 8*a*, respectively, and such arms pivotally support the opposite ends of a flexible and elongated chuck-carrying steel plate 10. This plate 10 is adapted to be adjusted to, and sustained, in different arch-form contours by means of a series of base-carried jack screws to be referred to hereinafter.

In carrying out the invention, one end of the flexible steel plate 10 has welded or otherwise secured thereto the sleeve 11 through which extends the pin 12 whose ends are pivoted in the upper portions of the bracket arms 6*a*.

The other end of the flexible chuck-carrying steel plate 10 is pivotally supported by the head of a T-bolt 14, there being sleeve elements 13 welded or otherwise fixedly secured to said plate end at opposite sides of the T-bolt stem 14*a*, as suggested in Fig. 1. The ends of the T-bolt head 14 extend beyond the outer ends of the sleeve elements 13 to be guidingly retained in the aligned and generally horizontal slots 15 which are formed in the opposite arms 8*a* of the U-bracket 8.

The stem 14*a* of the T-bolt 14 is threaded 14*b*, as indicated in Fig. 1, and slidably projects through an unthreaded guide hole 17 in the cross bar 16. This cross bar 16 is welded to the opposed inner surfaces of bracket arms 8*a* adjacent the rear top portions thereof, also as shown in Fig. 1.

The threaded guide stem 14*a* of the slidably mounted T-bolt 14 has threaded upon its outer portion an adjustable nut or wheel 18 whose hub portion 18*a* is adapted to bear against the outer surface of said cross bar 16 as shown in Fig. 1. Thus the adjustable mounting of the sleeved end 13 of the flexible steel plate 10 and the pivotal mounting 12 of its opposite end functions with the jack screws 19 to enable said plate to be adjusted to, and rigidly supported in, a number of different arch-form conformations when viewed in edge elevation as in Fig. 1.

Turning now to the jack screws 19, it will be noted from an inspection of Fig. 1 that they are arranged in spaced series lengthwise of the base plate 5 and the flexible steel plate 10 which they support.

The jack screws 19 and associated elements being duplicates of one another, a description of one assembly will suffice.

As shown in Fig. 1, each jack screw 19 is provided at its upper end with a fixedly attached and preferably metal sustaining pad 20 which is engageable with the underside of the flexible plate 10. The upper surface of each jack pad 20 is provided with a notch 20A (Fig. 2) to clear the chuck anchoring studs or screws 28.

The lower end of each jack screw 19 is slidably received in the central bore 22*a* of a bearing member 22, whose lower end 22*b* is received in a hole 24 in the base plate 5. The bearing member 22 has a circumferential outstanding flange 23 which is supported upon the top surface of the base plate 5, and screws 25 engaging flange 23 are provided to secure the bearing member 22 to the base plate 5.

Threaded upon each jack screw 19 is a conventional elevating nut 26 whose hub 26*a* bears against the upper end of the bearing 22 so that when said nut 26 is turned in one direction the jack screw will be actuated upwardly. When the nut 26 is turned in the other direction the related jack screw 19 will be forced downwardly into the bearing 22 through the action of the flexible steel plate 10, and its load.

Incidental reference has been made earlier herein to the work engaging chucks 27 which are shown in Fig. 1 as carried by the flexible steel plate 10 in longitudinal series with an intervening space between each chuck. One of these chucks 27 is illustrated in perspective on an enlarged scale in Fig. 3, while Fig. 2 illustrates one of said chucks in end elevation, the work and the flexible steel plate 10 being shown in cross section.

In further carrying out the invention, I provide each chuck 27 with a depending flange 27*a* at each side to engage the proximate side edge of the flexible steel plate 10 as indicated in Fig. 2 so as to prevent shifting of said chucks transversely of plate 10. The respective chucks 27 are secured to the flexible steel plate 10 against longitudinal shifting by means of headed screws 28 which extend through said flexible plate 10 from the under surface thereof and into tapped holes 29 in said chucks 27 as indicated in Fig. 1. The flanges 27*a* extend below the nether surface of the plate and receive the jack pads 20 between them. The flanges 27*a* thus serve to prevent lateral movement of the jack pads, as clearly shown in Fig. 2.

The chucks 27 are of the vacuum-operated variety and detailed reference to same will now be made, referring particularly to the disclosure in Fig. 3. As shown, the chucks 27 are square although they may, of course be otherwise shaped. In the illustrated embodiment of the chuck 27, opposite sides of the top portion provide the raised work-supporting flanges 30. These work-supporting flanges 30 parallel the depending spring-plate-engaging flanges 27*a* and are spaced outwardly from the endless top surface groove 31 which receives the vacuum sealing member 32.

The vacuum sealing member 32, which is of rubber or the like, provides the outwardly projecting wall and its widened base makes a snug fit in the chuck groove 31. The narrowed and flexible work-contacting outer portion 32*a* of the vacuum-retaining wall 32 projects, as shown, well beyond the plane of the work-engaging side flanges 30 of said chuck. Thus, the space between the work-engaging flanges 30 and the flexible vacuum-retaining wall portions 32*a* enables the latter to flex outwardly when forced into engagement with the work 41 so that the latter will be supported by the sustaining side flanges 30 of the chuck as indicated in Fig. 2.

Fig. 3 also illustrates that the chuck 27 has a central upwardly projecting rectangular boss 33 whose outer wall provides the inner wall of the vacuum wall-receiving groove 31. The outer end of the boss 33 terminates well short of the plane of the outer edges of the work-sustaining side flanges 30.

The waffle iron-like appearance of the outer end of the central boss 33 is produced by the intersecting air passage grooves 33*a*, 33*b*, which communicate with the vacuum-retaining wall 32 and with the central, and preferably shallow, clover form vacuum recess 34 in the outer end of said boss 33. The bottom 34*a* of the clover form recess 34 will preferably be substantially in plane with the bottoms of boss grooves 33*a*, 33*b*, as shown.

The bottom of what might be termed one leaf of the clover form recess 34 has the inwardly extending vacuum passage hole 35, the lower end 35*a* of which communicates with the vacuum passage 36. The vacuum passage 36 leads outwardly through one side of the chuck 27 and terminates in the threaded counterbore 37 for connection to the conventional suction line 38 which is indicated in Fig. 1.

The vacuum hole 35, 35*a* is shouldered adjacent passage portion 35*a* to support a layer of glass fiber or other filter material 40 which prevents foreign matter from getting into vacuum line 38. This filter material 40 is held in place by a screen-like grid 39 which is frictionally held in the enlarged inlet portion of hole 35 and seats on a shoulder as shown.

The suction opening or hole 35, 35*a* to the recess 34, while shown in a leaf formation of the clover form recess at one side, may be otherwise located and of course recess 34 may be of different shape. It will be understood that the intersecting surface grooves or passages 33*a*, 33*b*, of the waffle iron-like outer end of the boss 33 provide for the withdrawal of air from adjacent each of the vacuum-retaining wall portions to the clover form vacuum recess, as heretofore noted.

The operation of the device will doubtless be understood from the foregoing description, but can be summarized as follows:

The heavy gauge airplane wing skin or other work 41 which has been pre-contoured is disposed upon the chucks of two or more laterally spaced units such as is shown in Fig. 1. Then the jack screw nuts 26 are adjusted so that the jack screws 19 cause the flexible steel plate 10 to substantially conform to the bottom work surface with the vacuum-retaining chuck wall portions 32*a* making firm and uniform contact with the work 41. When necessary the shiftable pivot 14 will be adjusted by moving the stop nut 18 inwardly or outwardly in reference to the cross bar 16 which is carried by the bracket arms 8*a*.

When the vacuum retaining wall ends 32*a* all make proper contact with the under surface of the wing or other work 41, the line 38 is put under vacuum to exhaust air from the space enclosed by said vacuum walls 32, 32*a*. This causes the work-sustaining walls 30 to be drawn into supporting engagement with the undersurface of the work 41, the flexible outer portions 32*a* of the rubber vacuum retaining walls flexing to admit of this action. The work is firmly held during trimming or cutting operations and is readily released by relief of the vacuum in the line 38.

Having thus described the invention, what is claimed is:

1. In a multiple vacuum chuck holder or the like, the combination of a base, a superjacent flexible work load sustaining carrier member, a series of work retaining vacuum chuck members detachably mounted on said carrier member, each of said chuck members having depending side flanges embracing opposite edges of said carrier member, bracket means pivotally supporting opposite ends of said carrier member and carried by said base, means operable to effect longitudinal adjustment of one end of said carrier member relatively of said base, upstanding jacks carried by said base and extending in a series lengthwise of said base and carrier member, carrier member engaging and sustaining heads fixedly secured to the upper ends of the respective jacks for varying the attitude of the carrier member, and a vacuum line having connection with said chuck members for effecting the grip of the latter to the work.

2. In a multiple vacuum chuck holder or the like, the combination of a base, a superjacent flexible work load sustaining carrier member, a series of work retaining vacuum chuck members carried in longitudinal series upon the upper face of said carrier member, base carried means pivotally supporting opposite ends of said carrier member, means associated with one end of said carrier member and its base carried means for effecting longitudinal adjustment of said carrier member end, and an upstanding and deformable base carried supporting means for said carrier member and arranged lengthwise of the latter, and a vacuum line having connection with said chuck members for effecting the grip of the latter to the work.

3. The combination set forth in claim 2, in which said chuck members are detachably secured to said carrier member and have depending side flanges embracing side edges of the carrier member.

4. In a multiple vacuum chuck holder or the like, the combination of a base, a superjacent flexible work load sustaining carrier member, a series of work retaining vacuum chuck members detachably mounted on said carrier member, each of said chuck members having depending side flanges embracing opposite edges of said carrier member, base carried means pivotally supporting opposite ends of said carrier member, means operable to effect longitudinal adjustment of one end of said carrier member relative to said base, upstanding individually operable jacks carried by said base and extending in a series lengthwise of said base and carrier member, the upper ends of said jacks engaging the under surface of said carrier mem-

ber, and a vacuum line having connection with said chuck members for effecting the grip of the latter to the work.

5. A work holder comprising: an elongated flexible load supporting plate; individual means supporting the respective opposite ends of the plate; a row of jacks arranged lengthwise beneath the plate adjustably supporting that portion of the plate between the end supporting means, and adapted to selectively vary the attitude of the plate and to support it in a selected attitude; and a row of work-retaining vacuum chuck members secured in juxtaposed relation along the upper surface of said plate.

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