

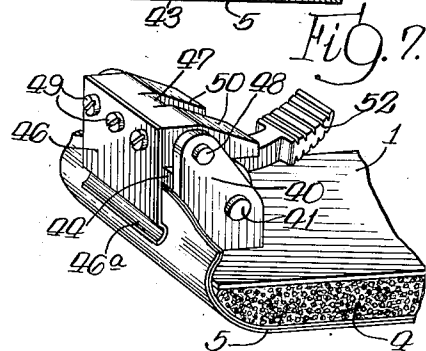
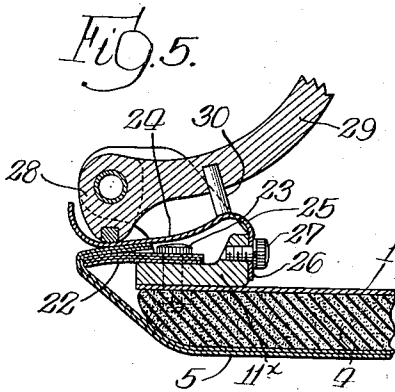
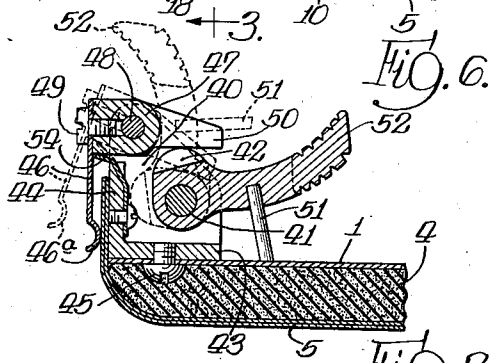
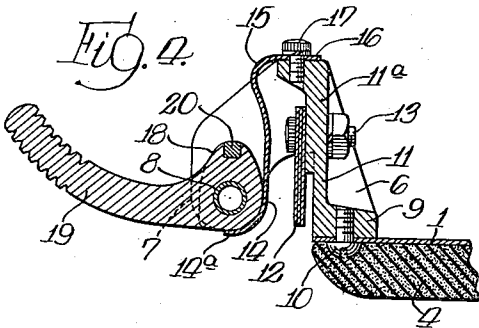
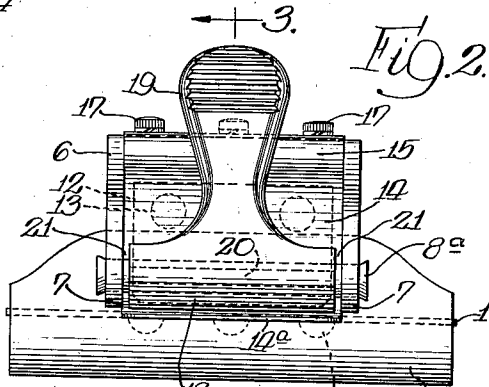
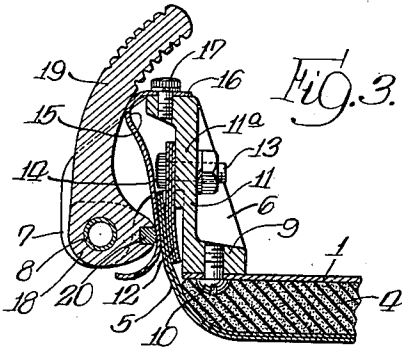
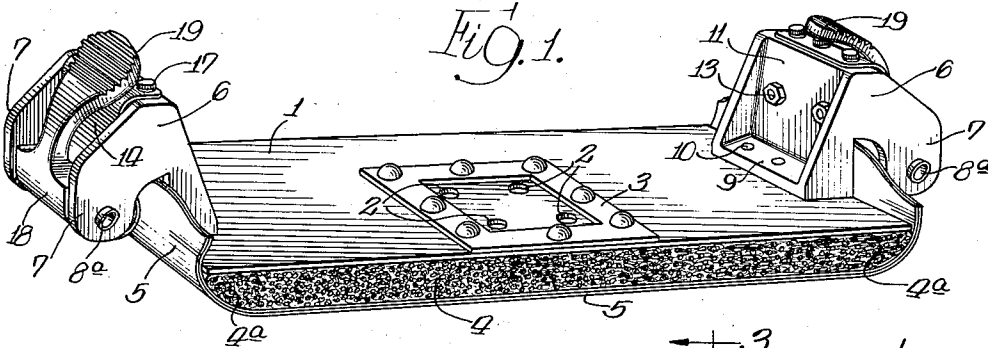
May 20, 1941.

C. H. RANDOLPH

2,242,545

RUBBING MACHINE

Filed March 27, 1940



INVENTOR.
Chalmers H. Randolph.
BY *Arne Carlsson*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,242,545

RUBBING MACHINE

Chalmers H. Randolph, St. Paul, Minn., assignor
to Sundstrand Machine Tool Co., Rockford, Ill.,
a corporation of Illinois

Application March 27, 1940, Serial No. 326,230

18 Claims. (Cl. 51-189)

This invention relates to a rubbing machine, and, more particularly, to the rubbing shoe thereof.

One object of the invention is to provide a novel and improved rubbing shoe having novel means for gripping the ends of an abrasive sheet to hold it in place on the shoe, such gripping means providing for convenient and quick attachment or detachment of the abrasive sheet by manual adjustment alone, and without the employment of a special wrench or other tool for adjusting the gripping mechanism.

Another object is to provide a novel and improved rubbing shoe employing abrasive sheet material and supporting the same with capacity for lateral and longitudinal flexibility, together with securing means adapted to hold the abrasive sheet in place without destroying or impairing the flexibility of the shoe.

A further object is to provide in a rubbing shoe of the character indicated, a novel clamping means adjustable to open position and conveniently disposed for the ready insertion of the end of an abrasive sheet, and readily adjustable into clamping relation thereto.

It is also an object of the invention to provide a clamp for a shoe of the character indicated having gripping jaws adapted to receive and effectively secure various thicknesses of abrasive sheet material.

Other objects, advantages, capabilities and features of the invention will hereinafter appear as the description proceeds.

Referring to the drawing:

Fig. 1 is a perspective view of a rubbing shoe embodying the invention.

Fig. 2 is an end elevation of the same.

Fig. 3 is a fragmentary vertical section taken as indicated at line 3-3 on Figure 2, showing the clamp in gripping position.

Fig. 4 is a vertical section taken at the same plane as Fig. 3, and showing the clamp in open position.

Fig. 5 is a fragmentary vertical section of a modified construction, being taken at the same plane as Fig. 3 in relation to the shoe, and showing the clamp in gripping position.

Fig. 6 is a vertical section of another modified form of gripping device, being taken substantially at the same plane as Fig. 3, and showing the parts in gripping position.

Fig. 7 is a perspective view of the structure shown in Fig. 6.

While the invention is susceptible of various modifications and alternative constructions, the

several embodiments shown in the drawing, and described hereinafter, are by way of preferred illustration only, and it is not intended that the invention be limited thereto or thereby, but it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as defined by the appended claims.

The rubbing shoe to which this invention is directed is designed to be connected to a rubbing machine having power means for actuating the shoe and imparting to it an oscillating or vibratory movement substantially in the plane of its abrasive working face. The shoe itself includes a flexible plate 1 made of any suitable resilient material, such as sheet steel, and, as shown in Fig. 1, it is provided with suitable holes 2 and with an attachment plate or frame 3, shown as riveted to the upper face of the plate 1 in position to receive and engage with the necessary and appropriate connecting elements of the operating mechanism. Suitably attached to the under side of the plate 1, as by an adhesive, is a yieldable resilient pad 4, which may be of sponge rubber or like material, and which is preferably formed with rounded ends, as seen at 4^a. Over the lower surface of the pad 4 one or more abrasive sheets 5, such as sandpaper, emery cloth or the like, are secured with the end portions extending around the rounded ends 4^a of the pad, and gripped by the novel clamping means hereinafter described.

The form of clamp illustrated in Figs. 1 to 4 includes a rigid bracket 6, having spaced arms 7, 7 which support a shaft or journal 8, shown as a tubular member, with its ends slightly flared, as by swaging, at 8^a, to retain it in the bracket. The bracket also includes a base flange 9 which is secured rigidly to the upper surface of the plate 1, as by screws 10, and from which there extends an upstanding web portion 11. A flexible and resilient gripping jaw 12 is shown as consisting of a plurality of rectangular sheets of resilient material, such as spring steel, clamped against a thickened portion 11^a of the web by bolts 13, so that the edge of this jaw 12, remote from its securing bolts 13, is normally spaced from the outer face of the web 11, as seen in Fig. 4. A movable gripping jaw 14 is composed of a single thickness of resilient sheet material and extends initially in a plane approximately parallel to the outer face of the jaw 12, as seen in Fig. 4, with its upper end portion bent in a smooth arcuate curve at 15, and terminating in a horizontal

lip 16 which is anchored to the flanged upper edge of the web 11 by screws 17.

A cam 18, of substantially elliptical cross-section, is journaled on the shaft 8 in contact with the movable jaw 14; preferably, the lower edge of the latter is curved to fit around the back of the cam member when the clamp stands at open position, as shown in Fig. 4. This provides a flaring mouth between the jaws 12 and 14, into which the edges of the abrasive sheet or sheets 5 may be easily introduced, and the resilient jaw member 14 is initially stressed away from the opposing jaw 12 so as to assume this position whenever it is permitted to do so by the position of the cam 18. The cam is provided with an integral lever arm 19 by which it may be readily rocked to the position shown in Fig. 3, in which its longer radius is presented toward the gripping jaws so that the movable jaw 14 is forced against the cooperating jaw 12, and the latter is flexed more or less, depending upon the number of sheets of abrasive material 5, or upon the thickness or nature of the sheets interposed between the jaws.

Preferably, the bracket 6 and the cam 18, with its lever 19, are made of aluminum to avoid adding unnecessary weight to the rubbing shoe, but the working face of the cam 18, which rubs against the surface of the steel jaw member 14, consists of an inset piece of bronze or like material, as seen at 20; and it is desirable that an appreciable amount of clearance be provided at 21, 21 between the ends of the cam member and the bracket arms 7, 7, so as to prevent the locking or jamming of the cam member by the packing of sludge and abrasive particles at these points, and also to insure some shifting of the cam upon the shaft 8 so that its working face at 20 shall not follow exactly the same track over the jaw member 14 in each successive operation.

The clamping movement of the cam 18 is limited by engagement of the arm 19 with the outwardly curved portion 15 of the jaw member 14, and this is designed to occur just after the bearing face 20 of the cam has passed "dead center" position, so that the reactive pressure of the clamping jaws against the cam 18 tends to lock the lever 19 in this position and thus prevents accidental opening of the gripping jaws. The lever arm 14, however, is several times as long as the effective radius of the cam at the bearing face 20, so that the locking pressure is easily overcome by manual operation of the lever 19 when it is desired to release the abrasive sheets 5. The open position of the lever 18 is then limited by the curved lower edge of the jaw member 14 extending under the cam at 14^a, and the resilience of the member 14 automatically swings the cam 18 and its lever 19 to this limit whenever the cam is released from its locked gripping position. Thus the parts are prepared for the ready reception of fresh sheets of abrasive material, which may be quickly secured in place by merely swinging the lever 19 back to its locking position against the curved stop surface at 15.

In Fig. 5 I have illustrated a clamp of modified construction, which may be so applied to the plate 1 of the rubbing shoe that its parts do not project quite so far beyond the end of the plate as do the bracket arms 7 and the cam member 18 of the structure of Figs. 1 to 4. In this modified form the bracket web 11^{*} is secured flatly to the upper face of the plate 1, as by bolts 23, which serve also to secure the flexible plates of the jaw 22 in position. The movable jaw 24 is quite similar in form to the jaw 14, being formed

with an arcuate bend 25 adjacent its end portion 26, and being secured to a flange of the web 11^{*} by screws 27. The cam member 28 is provided with a lever 29 which curves away from the web 11^{*} in locking position, so that the end of the lever 29 shall be spaced away from the plate 1 far enough to be easily accessible for release. A pin 30, or other projection carried by the lever, abuts the curved portion 25 of the jaw 24 to properly limit the rotation of the cam 28 in locking position. When the lever 29 is released, the resiliency of the jaw member 24 will separate it from the jaw 22 to permit withdrawal of the abrasive sheets 5, or insertion of new sheets to replace them.

Figs. 6 and 7 illustrate a further modification which even more effectively avoids the extension of the clamp device by any considerable amount beyond the end of the rubbing shoe proper. The bracket arms 40 which support the pivot shaft 41 for the operating cam 42, are integrally connected by a base portion 43 and an upstanding web 44. The base is attached to the plate 1 by screws 45, and the web 44 serves as a fixed jaw for the clamping device. The movable jaw is a plate 46 of flexible and resilient material, such as spring steel, carried rigidly by a rocker 47 fulcrumed on a shaft 48 which is carried by the bracket arms 40. The spring jaw 46 is shown as attached to the rocker by means of screws 49 set into the rocker at one side of the axis of the fulcrum shaft 48, and at the other side of this axis the rocker includes a pair of arms 50 which bear against the cam 42 so that when the long radius of the cam is extended toward the arms 50 the rocker is tilted about the shaft 48 and acts to swing the jaw 46 toward the fixed jaw 44 for gripping the ends of the abrasive sheets 5 between said jaws. Preferably, the lower edge of the jaw 46 is bent at 46^a to form a bead or convex bearing face to concentrate the gripping pressure and insure a firm hold upon the sheets.

The cam 42 is provided with an operating arm or handle 52, and with a projection or stop pin 51 which, as shown in Fig. 6, engages the plate 1 when the long radius of the cam 42 has just passed its "dead center" position in relation to the rocker arm 50. Thus the reactive force exerted by the flexure of the resilient jaw member 46 serves to hold the cam locked in this position past dead center, preventing accidental release of the sheets 5. But a slight upward pull on the arm 52 will rotate the cam back to release position, clearance space for the lever arm being provided at 53 between the twin arms 50 of the rocker member, as seen in Fig. 7, so that the cam 42 may have a substantially 90-degree range of movement. With the lever and cam thus moved to release position, a flat spring member 54 flexed over the upper edge of the part 44, presses upwardly against the outer end of the rocker 47 to swing the jaw 46 to its wide-open position, as seen in dotted outline in Fig. 6, and thus the gripping jaws are separated to fully release the abrasive sheets 5 or to receive new sheets to be gripped between them.

In all the forms of the invention just described the brackets which support the clamping mechanism are secured rigidly to the plate of the rubbing shoe at both ends, but these brackets are of very limited extent longitudinally of the plate and need cover only from one-third to one-half the width of the plate; hence they do not destroy or materially impair the flexibility of the shoe in either direction. Likewise, the clamping jaws,

gripping the ends of the abrasive sheets over less than half their width, leave these parts relatively free to twist or bend in conforming to flexure of the plate and pad of the shoe.

In the structures of Figs. 1 to 4 and Fig. 5, the resilience of the movable jaw insures automatic opening of the clamp device to receive the ends of abrasive sheets in the loading operation; and the spring 54 secures the same result in the structure of Figs. 6 and 7. And loading is further facilitated, in the first and third forms described, by reason of the fact that the clamping jaws open toward the plane of the plate 1, forming a receiving space between the jaws which extends transversely of the plane of the plate, and substantially perpendicular to it, so that the ends of the abrasive sheets are easily inserted in the clamp device as they are bent around the end of the pad 4 and plate 1.

The loading opening is ample to receive several sheets, if desired, while the resilience of the fixed jaws 12 and 22, and of the movable jaw 46, adapts the clamp to hold effectively on one or several sheets or with various grades of abrasive material.

Since, in each of the constructions shown, the cam bears against and slides over a part of the mechanism and not directly in contact with the abrasive material, the cam is not appreciably worn by use; and in the forms in which it works against the steel surface of a jaw member, such as the part 14 or the part 24, the life of the cam is further insured by the use of the bronze bearing strip inset in its face.

It may be noted that the bracket structure of Fig. 5 is very similar to that of Figs. 1 to 4, except that it omits the base flange 9; if this flange be cast a little thicker and milled off at an acute angle to the web 11, the clamp can be thus adapted for mounting with the opening between its jaws extending in a plane oblique to that of the plate 1. But in each form of the invention the clamping device is wholly self-contained so that its action imposes no stress or strain upon the shoe itself.

I claim as my invention:

1. In a rubbing shoe of the character disclosed having a plate over which an abrasive sheet extends with a resilient pad interposed and with the ends of said sheet extending around the ends of the pad, a clamping device for the abrasive sheet secured to each end of the plate, each clamping device including a resilient jaw and a cooperating jaw, both jaws being composed of relatively hard material presenting opposed gripping surfaces of substantial area, and cam means operable for moving one jaw toward the other.

2. In a rubbing shoe of the character disclosed having a plate over which an abrasive sheet extends with a resilient pad interposed and with the ends of said sheet extending around the ends of the pad, a clamping device for the abrasive sheet secured to each end of the plate, each clamping device including a resilient jaw and a cooperating jaw, with rotatably operable cam means arranged to move one jaw toward the other and a stop limiting rotation of the cam at a position past dead center in its jaw-closing movement.

3. In a rubbing shoe of the character disclosed having a plate over which an abrasive sheet extends with a resilient pad interposed and with the ends of said sheet extending around the ends of the pad, a clamping device for the abrasive sheet secured to each end of the plate, each

clamping device including a bracket attached to the plate, a resilient jaw and a cooperating jaw both mounted on the bracket, both jaws being composed of relatively hard material presenting opposed gripping surfaces of substantial area, and cam means carried by the bracket in operative relation to one jaw for forcibly moving it toward the other jaw.

4. In a rubbing shoe of the character disclosed having a plate over which an abrasive sheet extends with a resilient pad interposed and with the ends of said sheet extending around the ends of the pad, a clamping device for the abrasive sheet secured to each end of the plate, each clamping device including a bracket attached to the plate, a resilient jaw and a cooperating jaw both mounted on the bracket, and a rotatably movable cam journaled on the bracket in operative relation to one jaw and rotatable past a dead center position in a direction to force one jaw toward the other to clamp the abrasive sheet between said jaws, together with a stop surface limiting the rotation of said cam in clamping direction.

5. In a rubbing shoe of the character disclosed having a plate over which an abrasive sheet extends with a resilient pad interposed and with the ends of said sheet extending around the ends of the pad, a clamping device for the abrasive sheet secured to each end of the plate, each clamping device including a resilient jaw and a cooperating jaw, with cam means operable for moving one jaw toward the other, and a manually rotatable handle permanently connected with said cam means and constituting the sole means for operating it, said handle being movable away from the plane of the working face of the shoe when it actuates the cam in clamping direction.

6. In a rubbing shoe of the character disclosed having a plate over which an abrasive sheet extends with a resilient pad interposed and with the ends of said sheet extending around the ends of the pad, a clamping device for the abrasive sheet secured to each end of the plate, each clamping device including a bracket attached to the plate, a resilient jaw and a cooperating jaw both mounted on the bracket, and a rotatably movable cam journaled on the bracket in operative relation to one jaw and rotatable past a dead center position in a direction to force one jaw toward the other to clamp the abrasive sheet between such jaws, a manually operable lever rigidly connected with said cam, constituting the sole means for rotating it, and engageable with means fixed with respect to the bracket to check rotation of said cam slightly past its said dead center position.

7. In a rubbing shoe of the character disclosed having a plate over which an abrasive sheet extends with a resilient pad interposed and with the ends of said sheet extending around the ends of the pad, a clamping device for the abrasive sheet secured to each end of the plate, each clamping device including a bracket attached to the plate, a resilient jaw and a cooperating jaw both mounted on the bracket, the bracket including a pair of arms spaced apart, a cam disposed between said arms in position to move one jaw toward the other into clamping relation and pivotal supporting means for the cam carried by the arms, the cam being dimensioned to provide substantial clearance between its ends and the adjacent faces of said arms and being free to shift along the axis of its pivotal support within the limits of such clearance.

8. In a rubbing shoe of the character indicated having a plate over which an abrasive sheet extends, with a resilient pad interposed between them, and with the ends of the sheet extending around the ends of the pad, a clamping device for said sheet secured to each end of the plate, each clamping means including a bracket attached to the plate, a resilient jaw secured to the bracket, a movable jaw supported on the bracket and a cam rotatably mounted on the bracket operating on the movable jaw substantially opposite the gripping area of said resilient jaw and formed to force it toward the other jaw for gripping one end of the abrasive sheet when said cam is rotatively adjusted.

9. In a rubbing shoe of the character indicated having a plate over which an abrasive sheet extends, with a resilient pad interposed between them, and with the ends of the sheet extending around the ends of the pad, a clamping device for said sheet secured to each end of the plate, each clamping means including a bracket attached to the plate, a movable jaw and a cooperating jaw both supported on the bracket with cam means carried by the bracket in operative relation to the movable jaw for forcing it toward the other jaw, said movable jaw being yieldingly urged in the opposite direction for opening automatically when the cam means is operated to release it.

10. In a rubbing shoe of the character indicated having a plate over which an abrasive sheet extends, with a resilient pad interposed between them, and with the ends of the sheet extending around the ends of the pad, a clamping device for said sheet secured to each end of the plate, each clamping means including a bracket attached to the plate, a resilient jaw secured to the bracket, a movable jaw supported on the bracket and a cam rotatably mounted on the bracket in operative relation to the movable jaw and formed to force it toward the other jaw for gripping one end of the abrasive sheet when said cam is rotatively adjusted, said movable jaw being also resilient and being initially stressed away from the other jaw for opening automatically when the cam is rotated in reverse direction to release it.

11. In a rubbing shoe of the character indicated having a plate over which an abrasive sheet extends, with a resilient pad interposed between them, and with the ends of the sheet extending around the ends of the pad, a clamping device for said sheet secured to each end of the plate, each clamping means including a bracket attached to the plate, a resilient jaw secured to the bracket, a movable jaw supported on the bracket, and a cam rotatably mounted on the bracket bearing against the movable jaw and rotatable past a dead center position in a direction to force said jaw toward the other jaw in clamping relation, said movable jaw being also resilient and constantly stressed against the cam whereby it automatically returns the cam to full release position after an initial reverse movement of the cam over dead center.

12. In a rubbing shoe of the character disclosed having a plate over which an abrasive sheet extends with a resilient pad interposed and with the ends of said sheet extending around the ends of the pad, a clamping device for the abrasive sheet secured to each end of the plate, each clamping device including a resilient jaw and a cooperating jaw, said jaws embracing an opening to receive the end of the abrasive sheet extending in a plane transverse to the plane of

the plate and adjacent the end of said plate, and a rotatable cam bearing on one jaw substantially opposite the gripping area of the other jaw and operable for moving said one jaw toward the other to clamp the sheet.

13. In a rubbing shoe of the character indicated having a plate over which an abrasive sheet extends, with a resilient pad interposed between them, and with the ends of the sheet extending around the ends of the pad, a clamping device for said sheet secured to each end of the plate, each clamping means including a bracket attached to the plate, said bracket providing a flat jaw in a plane substantially perpendicular to the plate at the end thereof, a rocker pivotally supported by the bracket on an axis parallel to the plate and above it, a second jaw carried by the rocker and having a relatively broad, convexly rounded gripping area extending opposite the first jaw, and cam means pivoted on the bracket and operable against the rocker to swing said second jaw toward the first jaw in clamping relation thereto.

14. In a rubbing shoe of the character indicated having a plate over which an abrasive sheet extends, with a resilient pad interposed between them, and with the ends of the sheets extending around the ends of the pad, a clamping device for said sheet secured to each end of the plate, each clamping device including a bracket attached to the plate, said bracket providing a jaw in a plane substantially perpendicular to the plate at the end thereof, a rocker pivotally supported by the bracket on an axis parallel to the plate and above it, a second jaw carried by the rocker and extending opposite the first jaw, and a cam rotatably supported by the bracket between the plate and the rocker and operable against the latter to tilt said rocker about its pivot axis and thereby swing the second jaw toward the first jaw in clamping relation thereto.

15. In a rubbing shoe of the character indicated having a plate over which an abrasive sheet extends, with a resilient pad interposed between them, and with the ends of the sheet extending around the ends of the pad, a clamping device for said sheet secured to each end of the plate, each clamping device including a bracket attached to the plate, said bracket providing a jaw in a plane substantially perpendicular to the plate at the end thereof, a rocker pivotally supported by the bracket on an axis parallel to the plate and above it, a second jaw carried by the rocker and extending opposite the first jaw, and a cam rotatably supported by the bracket between the plate and the rocker and operable against the latter to tilt said rocker about its pivot axis and thereby swing the second jaw toward the first jaw in clamping relation thereto, together with spring means on the bracket reacting against the rocker in a direction to open said jaws upon release of the cam pressure against the rocker.

16. In a rubbing shoe of the character indicated having a plate over which an abrasive sheet extends, with a resilient pad interposed between them, and with the ends of the sheet extending around the ends of the pad, a clamping device for said sheet secured to each end of the plate, each clamping means including a bracket attached to the plate, said bracket providing a jaw in a plane substantially perpendicular to the plate at the end thereof, a rocker pivotally supported by the bracket on an axis parallel to the plate and above it, a resilient jaw carried by the rocker and extending opposite the first jaw,

and cam means operable against the rocker to swing said resilient jaw toward the first jaw in clamping relation thereto, together with stop means limiting rotation of the cam means at a position past dead center in the clamping movement.

17. In a rubbing shoe of the type indicated having a flexible plate over which an abrasive sheet extends with a resilient pad interposed and with the ends of said sheet extending around the ends of the pad, a clamping device at each end of the plate, each clamping device including gripping jaws and means for adjusting them into clamping relation to the end portion of the sheet,

5 together with a base by which said jaws are carried, said base being secured rigidly to the plate but having a bearing area against the plate which is relatively small in longitudinal direction and which does not extend across substantially more than half the width of said plate, to avoid impairing the flexibility thereof.

10 18. In the combination defined in claim 17, said gripping jaws being dimensioned to grip the middle portions of the abrasive sheet at its ends respectively and to engage not substantially more than half the width of the sheet.

CHALMERS H. RANDOLPH.