May 1, 1945. C. A. WIKEN 2,374,716

GRINDER

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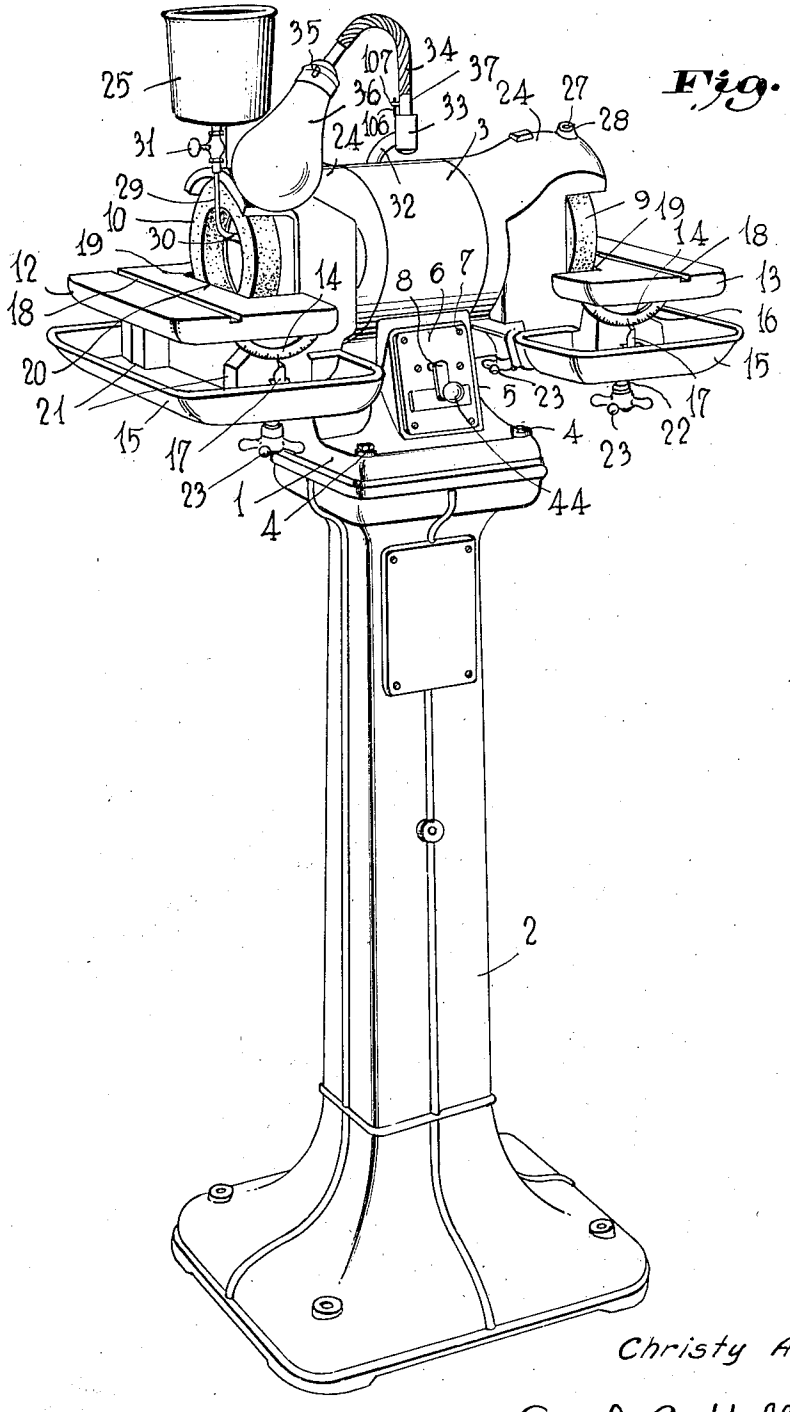

Fig. 1

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GRINDER

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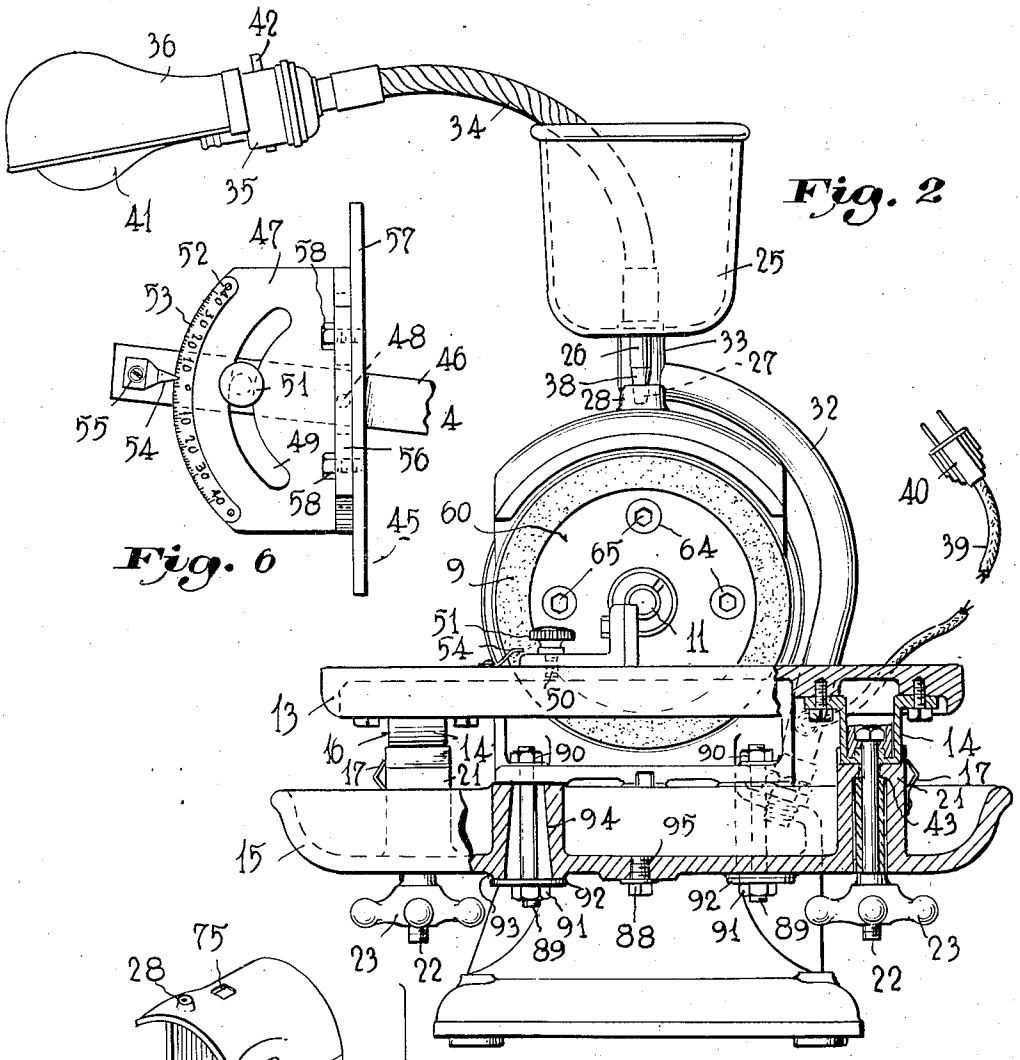

Fig. 2

Fig. 6

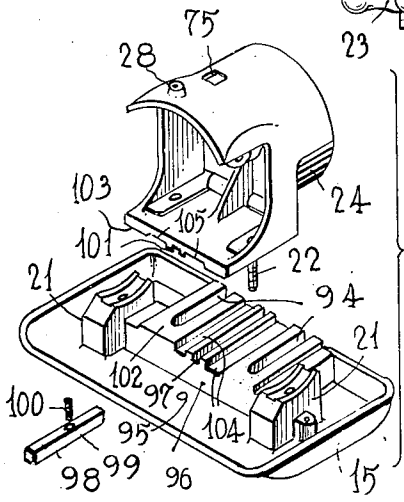

Fig. 7

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GRINDER

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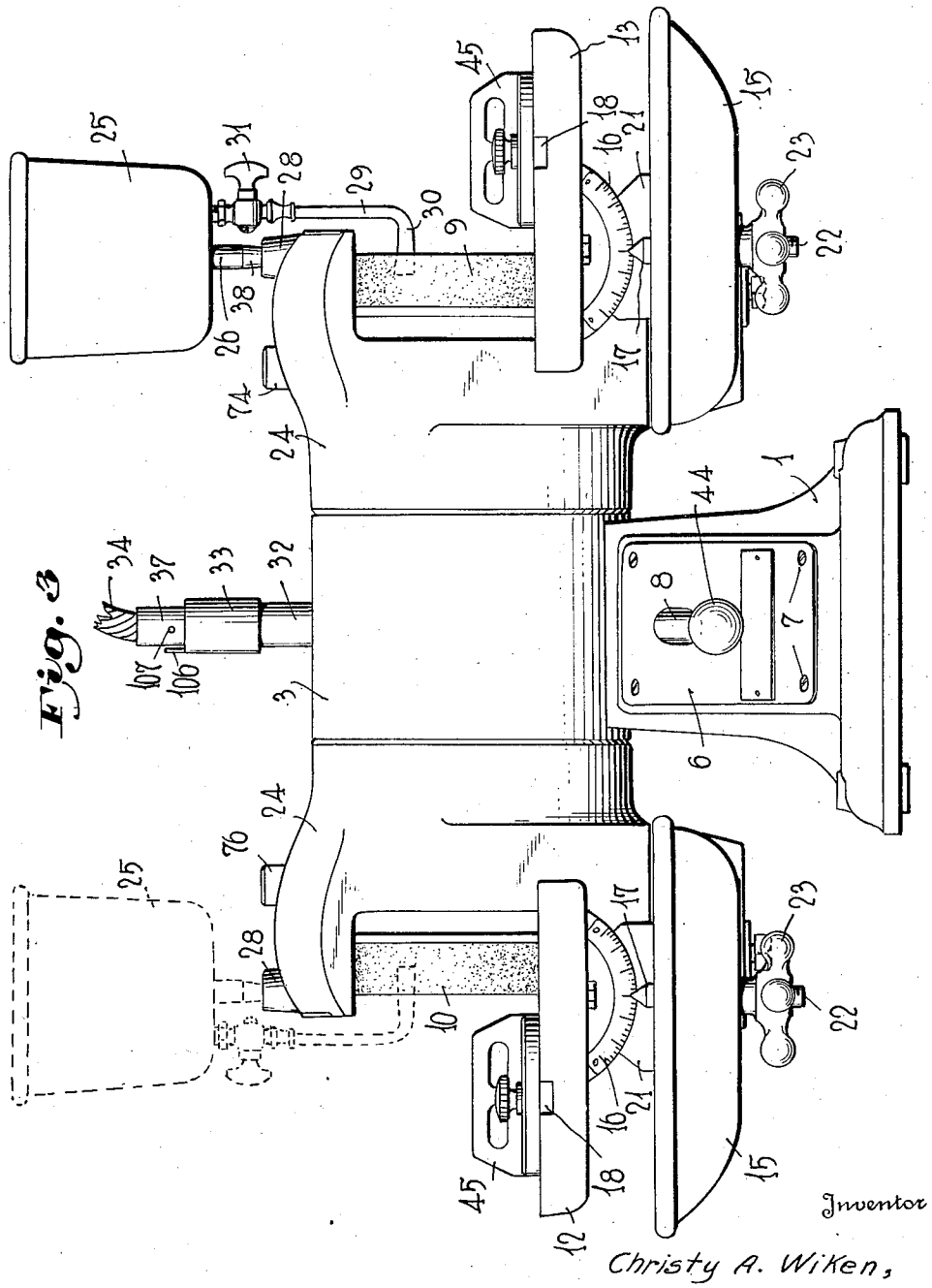

Fig. 3

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GRINDER

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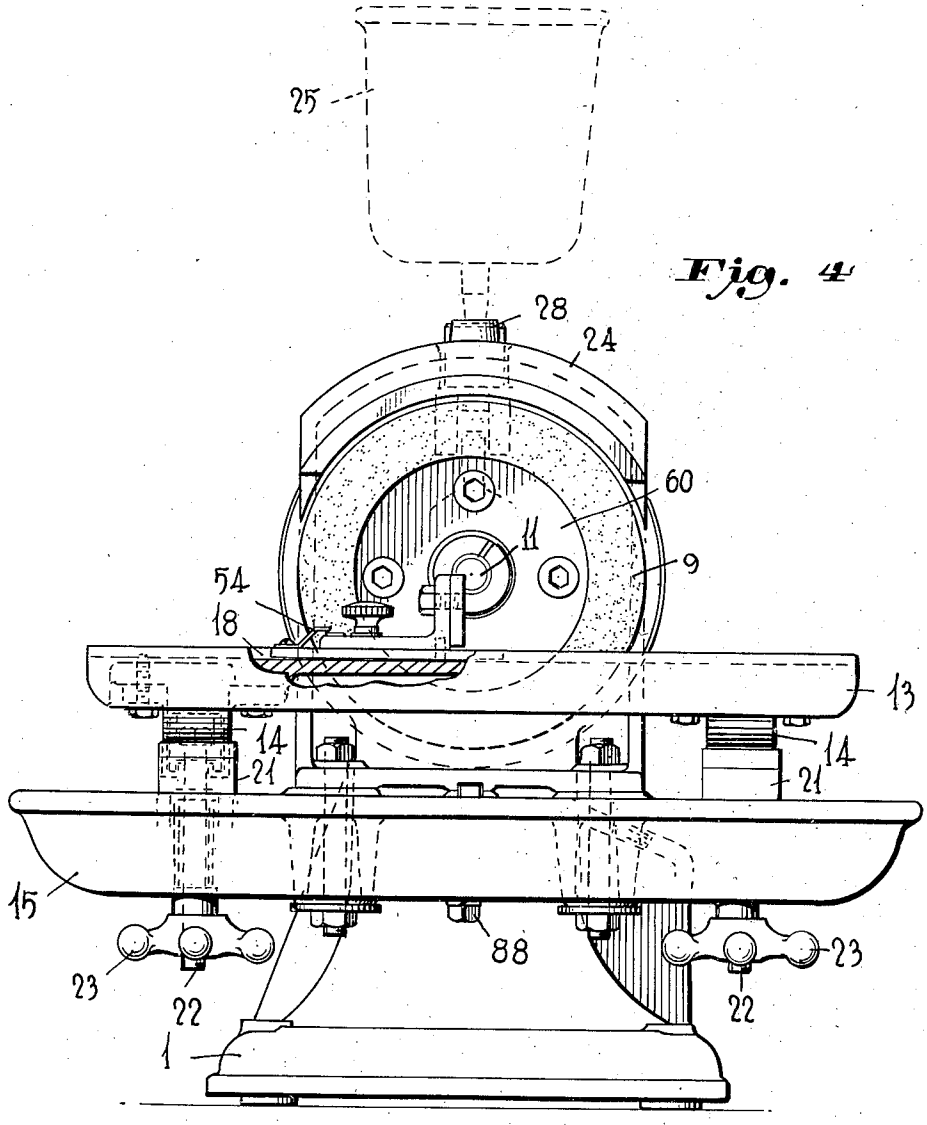

Fig. 4

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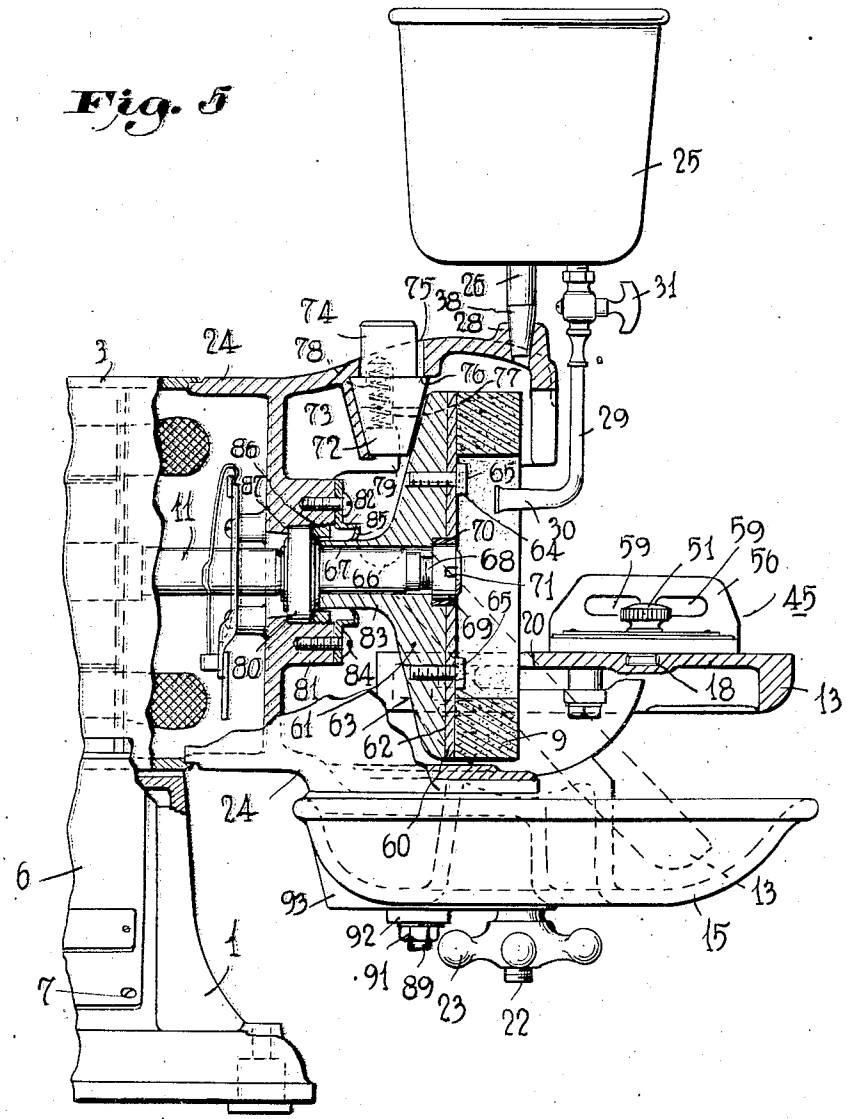
Fig. 5



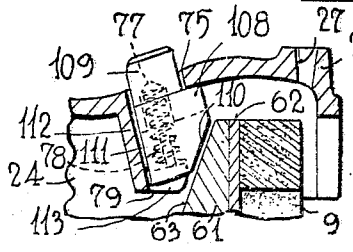


Fig. 8

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Patented May 1, 1945 2,374,716

UNITED STATES PATENT OFFICE

2,374,716

GRINDER

Christy A. Wiken, Milwaukee, Wis., assignor, by mesne assignments, to The Delta Manufacturing Company, a corporation of Delaware

Application February 28, 1942, Serial No. 432,847

14 Claims. (Cl. 51—109)

The present invention relates to grinders intended for convenience in grinding tools, especially tools which are provided with cutting tips including tungsten carbide or similar extremely hard material. Such tools are used extensively at present, and usually consist of shanks or body portions of steel, having the hard cutting tips secured thereto, as by welding or sintering.

The grinder is preferably designed to run at a high speed, say approximately double that of the standard four-pole 60 cycle alternating current motor, the grinding wheels being carried directly at the ends of the motor shaft, the wheels being of such size as to give a surface speed of the order of a mile a minute at the cutting location. Preferably the two wheels are of different coarseness of grain, and contain silicon carbide or other abrasive material of equivalent or even greater hardness, for example diamond.

The grinder is preferably made by providing a special base, directly on the frame of the motor, or constituting a part of the frame of the motor, this base or pedestal being of sufficient height to raise the shaft of the motor enough to allow the grinding tables and waste receiving troughs to be manipulated from their under sides when the pedestal is mounted upon an ordinary work table or bench. A special floor pedestal is also provided which will take the place of a work bench and cooperate with the grinder base to raise the machine to a suitable height when the pedestal is mounted directly on the floor.

The work tables and waste receiving troughs are preferably made as unitary assemblies wherein the trough portion is secured to the motor frame or pedestal in such way that it may be slid in and out in a direction parallel to the axis of the grinder shaft and clamped at a selective position, so as to bring the table carried thereby to the desired spacing from the side of the wheel.

The table is mounted on trunnions carried by the trough member in such way that it may be tilted about an axis situated in a plane parallel to the side of the wheel and lying substantially in the top of the table itself, so that the table may be tilted freely without appreciably varying the spacing between the wheel and the adjacent edge of the table, to facilitate grinding the tools at any desired angle, graduations being provided adjacent the trunnions to indicate the angle of tilt.

Each of the work guiding tables is capable of tilting in both directions, that is toward and from the wheel, through a relatively large angle and a groove preferably is provided in the table top to cooperate with a grinding gage having a tilting graduated head, to guide said gage in a direction parallel to the cutting face of the wheel while holding the tool at the correct angle to the said surface.

Means of electrical nature are provided for starting and stopping the motor, preferably such that the direction of rotation may be reversed when desired. This makes it possible to grind either right or left hand angles on the tools, by using the front or rear portion of the wheel, while always having the portion in use moving downwardly adjacent the cutting location.

Since the motor preferably is of the high-speed type, it is desirable to provide means for bringing it to rest quickly, to facilitate rapidly stopping and reversing it when necessary. It will be understood that the relatively heavy rotating elements, including the rotor or armature of the motor and the grinding wheel or wheels, have considerable momentum when turning at such high speeds, and, because of the ball-bearings, if left to themselves would spin for an annoyingly long time, before the operative could reverse the rotation. A simple but effective brake has therefore been devised, to dissipate this momentum when necessary.

A water pot is provided, having means whereby it readily may be held securely adjacent either wheel, but yet is removable instantly without loosening any screw or other securing means, so that the pot easily may be removed bodily for filling, emptying or cleaning or for shifting it to the other side of the grinder. This pot has an outlet tube having a bent discharge end, and a stop cock for controlling the rate of flow of the water or other liquid, the grinding wheels preferably being of the recessed type so that the bent discharge end of the outlet tube may enter into the recess of either wheel.

A feature of the invention is to provide removably mounted sludge pans carried adjustably by the end frame of the motor, which also constitute wheel guards. These pans in turn have integral elevated portions therein for supporting the table trunnions and other raised portions whereby the pans are secured to the end frame. By this means the machined surfaces of the pan are raised above the level of the rim of the pan so that no liquid collected in the pan can reach them, thus assuring against corrosion and soiling of the trunnions and the supporting surfaces of the pans.

A further feature of the invention is to provide a guide bar for the tool being ground, said guide bar being secured adjustably to the grinding gage. This is preferably accomplished by se-

curing the bar to the gage by means of one or more screws, passing through a slot or slots in the bar. By this construction, the end of the bar may be brought close to the grinding wheel even when the gage is tilted to a relatively great angle, so that the tool may be guided and supported more precisely.

A light fixture preferably cooperates with the grinder and is pivoted at a point substantially vertically above the center of the motor frame. It comprises a flexible tubular conduit carrying a lamp socket and shade at its outer end, and pivoted near the motor at its other end, a stop being provided at the pivot whereby the rotation is limited to slightly less than 360° so that the lamp may be shifted practically anywhere over the device, but nevertheless the electrical wires cannot be twisted off by continuous turning in one direction.

An advantage of locating the pivot of the light fixture above the center of the motor is that the lamp may then be brought adjacent each of the four grinding locations without bending or otherwise adjusting the conduit, since these four grinding locations are equidistant from the pivot.

From the above summary of objects and structural features of the grinder, it will be clear that the general object is to provide a high speed reversible grinder having means for guiding the article to be ground at a definite angle to the cutting surface of the wheel, while supplying a coolant such as water thereto, providing also a source of illumination which may be shifted to practically any desired position to illuminate the work, means being also provided to catch any dripping or sludge and so arranged that they may readily be removed from the machine for emptying and cleaning.

Other objects and advantages of the invention in part will be particularly pointed out by reference to a specific form of the invention selected as an example and described and illustrated in the present specification and the drawings accompanying the same, and in part will be obvious from the said disclosure.

In the drawings:

Fig. 1 is a perspective elevation of the machine mounted upon an individual pedestal;

Fig. 2 is a partly broken-away end view of the grinder on an enlarged scale, without the pedestal, as seen from the right in Fig. 1;

Fig. 3 is a front elevation of the machine shown in Fig. 2;

Fig. 4 is an end elevation of the machine from the same end as that shown in Fig. 2, partly broken away;

Fig. 5 is a fragmentary elevation partly broken away and in central section along a vertical plane passing through the axis of the motor shaft;

Fig. 6 is a fragmentary plan view of a work guide adapted to cooperate with the work holding tables of the grinder, the guide bar being partly broken away;

Fig. 7 is an exploded view showing a portion of the frame of the grinder and a drip pan cooperating therewith; and

Fig. 8 is a fragmentary detail, with parts in section, showing a modified brake device.

In all the figures corresponding elements are designated by the same reference characters.

Referring first to Fig. 1 there is shown a motor 3 provided with a base or pedestal 1 which in turn is mounted on the relatively tall pedestal or column 2 and secured thereto by any suitable fastenings such as the cap screws 4. It will be understood that the pedestal 2 need not be used, when a work bench or other support is available, in which case the base 1 may be mounted directly on such bench or the like. The pedestal 2 however affords a convenient means for supporting the grinder as it may be secured to the floor wherever desired if the installation is to be permanent, or may be moved about as preferred if not fastened to the floor. The column or pedestal 2 thus affords ready access to all sides of the grinder which may be an advantage in some instances.

The base 1 differs from the bases customarily found on electric motors in that it is much taller so that it raises the motor shaft sufficiently high to accommodate the necessary mechanism between the grinding wheels and the top of the work bench upon which the base may be mounted, when the column 2 is not used. The base 1 has a casing 5 projecting from a portion thereof to accommodate the switch plate 6 secured to the base 1 by any suitable means such as the screws 7. The switch contained in the casing 5 terminates in the handle 8, having thereon the knob 44 for ease of operation, and preferably is a reversing switch having an "off" position at the center of its stroke, the position shown in Fig. 1, and providing opposite directions of rotation of the motor shaft when thrown to the right or left of said "off" position. The motor shaft 11 (Fig. 2, etc.) carries the two recessed or annular grinding wheels 9 and 10 at its ends, these wheels being preferably of materially different grits, so that one will serve for rapid cutting while the other will provide a smooth and accurate finish. By reason of the reversibility of the motor 3, it becomes possible to grind on either the forward or rearward portion of each wheel, since it is customary to grind only on the descending portion of an abrasive wheel to prevent the wheel from lifting the work piece from the work table and thus causing inaccuracy or chatter.

Each wheel has a work table, 12 or 13, cooperating therewith, these tables being mounted on elevated trunnions 14 carried by the sludge pans 15 located below the respective tables and adapted to receive drippings and waste from the grinding. At the front each table has a scale 16 cooperating with a pointer 17 to indicate the inclination of the table top to the horizontal, and preferably a generous angle of tilt in each direction is provided to take care of the angles ordinarily encountered in the tools to be ground, for example a tilt of 30° toward the wheel and 45° away from the wheel.

In order to guide the pan 15 and consequently the table and other elements carried thereby, when the pan slides toward or away from the grinding wheel as above stated, an integral raised portion 96 is provided in each pan as best shown in Fig. 7. This raised portion has an upper surface 102 which is substantially plane and normally is in contact with the corresponding plane under surface 103 of the frame 24.

A slot 97 is formed in the raised portion 96 and a corresponding slot 101 is formed in the under surface of the frame 24. These slots are preferably formed as rectangles, so that for example a rectangular key 98 may be fastened to the raised portion 96 by means of a screw 100 passing through a counter-sunk opening 99 in the key and threaded into the portion 96, whereby the upper portion of the key 98 will be received in the cooperating groove 101 of the frame 24.

Other grooves such as 104 and 105 may be provided in the original castings, in the adjoining surfaces of the pan and the frame, so that less material need be machined in forming the coacting guide surfaces on said elements.

Each pan 15 has a discharge opening 95 (Fig. 2) in the bottom thereof into which is threaded a plug 88, which may be a standard pipe plug. This permits draining the contents of the pan 15 when desired, but preferably the entire pan will be removed bodily from the grinder at intervals, to permit flushing and cleaning, which is much more satisfactorily accomplished by holding the entire device under a stream of water which will carry away all the sludge, etc.

Each pan is secured to the frame 24 of the grinder by means of studs 89 threaded through the frame and extending downward through open-ended slots 94 in the pan. As shown, each stud has at its upper end a lock nut 90 and at its lower end a nut 91, a washer 92 being interposed between the nut 91 and the flat bottom portion 93 of the pan.

Upon loosening the nuts 91, the entire pan 15 is free to slide toward or away from the grinding wheel, and may be adjusted to the desired spacing from said wheel to hold the table in correct position for the work to be done, or may be slid out entirely for emptying and cleaning. Upon tightening the nuts 91 the pan will be retained in any desired position of adjustment.

As already mentioned, the bearings 21 extend above the level of the top of the pans, thus keeping the trunnions 14 well above any possible sludge or liquid in said pans, and likewise the surfaces 102 and 103 are maintained above said sludge.

Each of the tables, 12 and 13, which are alike in all respects except that the scales 16 are at opposite ends with relation to one another, has a slot or groove 18 therein for guiding a grinding gage which will be described later and also has a rectangular portion 19 cut away so that the table may surround the end surface as well as the front and rear of each wheel 9 and 10. The edge 20 of this opening 19 is preferably substantially coincident with the axis of tilt of the tables so that when the tables are tilted the said edge 20 will remain practically at the same distance from the end surface of the corresponding wheel.

The trunnions 14 are supported on journals or bearings 21 integral with or attached to the pans 15, and clamping means are provided, in the form of bolts 22 passing through the bearings 21 and to the inside of the trunnions 14, with a star wheel 23 threaded on each bolt for clamping the table in adjusted position, as will be described in greater detail later.

A shield 24 is provided at each end of the motor 3 and serves the triple purpose first, of guarding the abrasive wheel, second, providing a support for a water pot 25 which has a preferably brass rod 26 projecting downward therefrom to be received in an opening 27 in a lug 28 provided on each shield 24, and third, supporting the pans and tables. The shield of course also constitutes an integral part of the motor bracket or end plate, which supports the shaft bearings.

The bore 27 preferably is tapered and a corresponding taper is formed at the end of the rod 26 to provide a satisfactory fit. An outlet tube 29 extends from the water pot 25 and is in communication with the interior thereof, and is bent at its end as shown at 30 to enter the recess in either wheel 9 or 10, a stop cock 31 being provided to control the flow of liquid through said tube 29.

An advantage of this construction is that the tapered joint between the water pot and the shield 24 provides a joint which always holds the pot securely and firmly, the friction of the tapered joint permitting adjustment and removal, while effectively preventing vibration from shifting the parts accidentally.

A relatively stiff conduit 32 is secured to any convenient portion of the motor 3 or base 1 and terminates in a fitting 33 from which extends a flexible conduit 34 carrying a lamp socket 35 and lamp shade 36. The conduit 34 may be bent at will to bring the lamp carried in socket 35 to a suitable position to illuminate the work piece and a pivot joint is provided in the fitting 33 whereby the companion fitting 37 at the end of the conduit 34 may rotate through substantially 360°, but is restrained from turning beyond a full turn in either direction, so that the electrical conductors passing to the lamp through the conduits 32 and 34 cannot be twisted off accidentally by continued rotation in one direction. By thus providing substantially 360° rotation, the lamp may be brought to any required position without danger to the wiring. For example, a pin 106 on the stationary fitting 33 may coact with a pin 107 on the fitting 37, to limit the rotation as stated.

Passing now to Figs. 2 and 4 there is shown a lamp 41 controlled by switch 42 and mounted in socket 35, the lamp being fed through the electrical cord 39 passing through conduits 32 and 34 and having the attachment plug 40 at its free end.

While many advantages may be obtained from the illuminating device just described, additional advantages result when the pivot-fitting 33 is located substantially vertically above the center of the motor. In this position, it is obvious that the conduit 34 need be bent only once to the proper shape to bring the lamp 41 carried in the socket 35 to the correct position adjacent each of the four locations at which grinding will be done, namely, near the front and rear of each wheel. This is true because of the symmetrical arrangement of the wheels and tables with respect to this location of the pivot for the conduit, namely a pivot which is equidistant from the four work stations.

Figs. 2 and 4 show clearly the arrangement of the two journals 21 for the trunnions 14 of table 13, the bolts 22 extending through bores 43 in said journals with their heads within the trunnions so that tightening the star wheels 23 will draw said trunnions firmly against their bearings, to clamp the table 13 in any adjusted position.

It will be noted that the table trunnions 14 are maintained entirely above the level of the top of the pan 15, because of the bearings 21 rising from the bottom of said pan and extending over the top thereof. This keeps any liquid or sludge in the pan from seeping into the joint between the trunnion 14 and its bearing 21.

The under surface 103 of the shell 24 likewise is maintained above the sludge level by reason of the elevated portion 96 of the pan, the top 102 of said portion likewise being at a higher level than the top of the pan. This keeps the joint between pan and shell free from liquid and dirt, and prevents rusting, etc.

Fig. 2 shows the tapered end 38 of the rod 26

engaged in the bore 27 in lug 23 on shell 24 to hold the water pot 25 correctly.

A gage 45 for guiding the work piece is provided as shown in Figs. 2 to 6. This gage comprises a flat bar 46 guided slidably in the groove 18 and fitting interchangeably in either table 12 or 13.

The gage comprises a head 47 pivotally mounted at 48 on the guide bar 46 which slides in one of the grooves 18 in the tables. This pivotal connection is here indicated as provided by a lug or pin 48 on one of said members rotatable in a corresponding hole in the other member. The head 47 has a slot 49 therein, preferably formed as an arc concentric with the said pivot and a screw 50 projects downward through said slot, and is threaded into corresponding threads in the bar 46. It preferably has a knurled head 51, for convenient manual operation.

An inclined surface 52 is provided at the front of the head 47, and carries a scale 53 which thus may be read either from above or from in front, by means of a pointer 54 secured to the bar 46 by a screw 55 or other suitable device, whereby a slight degree of adjustment of the pointer is made possible to permit setting the reading point accurately.

At its rear the plate 47 preferably has an upstanding flange 56 which may serve directly as a guide for the tools being ground in many cases. It will be noted that when the flange 56 is at right angles to the guide bar 46, or not far from such right angle position, the end of the flange 56 will approach fairly close to the cutting surface of the wheel, and thus will afford firm support for the work piece.

However, when the flange 56 is inclined at a much smaller angle, the end of the same will not approach closely enough to the grinding surface to afford adequate support for the tool, and in such cases it is advantageous to provide a supplemental guide for the tool, consisting of the plate or bar 57 which is longer than the flange 56 and is secured flat against said flange by means of the cap screws 58.

The bar 57 thus constitutes a substitute guide, and of course is made of uniform thickness so that its outer surface will be parallel with the guiding surface of the flange 56. The screws 58 will pass through the openings 59 in the flange 56, which are elongated so that when the screws are loosened, the bar 57 may be moved toward or away from the wheel.

It will be noted that the grinding wheels preferably used consist of an annulus of abrasive material secured to a backing disk of metal or the like, as shown for example at 60 in Figs. 2, 4 and 5. These wheels are mounted on flanges 61, having a flat outer face 62 abutting against the disk 60, and a conical inner face 63, which affords means for applying a braking force to the rapidly rotating wheel, as will be described later.

A plurality of screws 64 having recesses or sockets 65 therein for engagement with a polygonal wrench, are preferably provided for holding the wheels in place. Each flange 61 is secured to a corresponding end of the motor shaft 11 in any suitable manner, as by means of a Woodruff key 66 engaged in an arcuate depression in the shaft 11 and extending into a keyway 67 in the hub of the flange 61, each end of the shaft preferably being reduced in diameter and threaded as indicated at 68 to receive a round nut 69 extending into a corresponding bore 70 in the flange, said nut having a slot 71 therein so that it may be tightened by a suitable spanner.

As stated, the conical surface 63 provides means for braking the wheel. This is accomplished by forcing a wedge 72 against said conical surface. It has been found that a wedge made of suitable hard-wood, for example maple, is very satisfactory as a brake block. As inclined surface 73 is provided on the stationary part 24 of the motor frame, and the opposing surfaces of the wedge 72 are substantially parallel with surface 73 and surface 63 of the cone respectively, so that when the block 72 is depressed it will bear against both said surfaces.

It has been found desirable to incline both surfaces of the wedge to the vertical, so as to increase the angle of the wedge, in order to prevent gripping, as otherwise difficulty might be experienced in causing the brake block to release the wheel when the braking has been accomplished. The block 72 has a portion 74 extending out of a hole 75 in the casing 24, and preferably has a shoulder 76 to engage the under surface of the casing around said hole 75 when in its released position.

In order to hold the brake block 72 normally in its uppermost or disengaged position, it is provided with a bore 77 in which is housed a spring 78 bearing against the upper end of the bore and bearing also against a projection 79 formed on the casing 24, the brake block being slotted at its lower end so as to straddle the lug 79, which therefore serves both to guide the wedge block 72 in its motion and to prevent turning thereof, so that the wedging surfaces will always be in proper position for service.

The motor frame 24 is formed with a projecting boss 81 bored to receive a ball bearing 80, preferably of the type which is originally provided with sufficient lubricant to serve throughout its life, and sealed against loss of lubricant or entrance of foreign matter. A further protection for the bearing is provided by the flanged ring 82 surrounding the hub 83 and secured to the boss 81 by screws 84 as indicated.

This ring 82 carries a closure of flexible and pliable material, such as oil-impregnated leather 85 bearing lightly against the hub 83 to prevent entrance of grit or moisture. The ball bearing 80 is retained against a seat 87 in the boss 81 by means of the externally threaded ring 86 which is screwed into corresponding threads within the boss as shown in Fig. 5.

While the motor illustrated conventionally is of the induction type, it will be understood that no restriction is placed upon the nature of such motor, which equally well may operate on any type or voltage of electrical energy.

Instead of using the brake block 72 shown in Fig. 5 and hereinbefore described, an alternative form may be preferred and is illustrated in Fig. 8. In this case practically the only change is that the modified brake block 108 takes the place of brake block 72. Block 108 has an upper end 109 projecting through the hole 75 in the casing 24.

This brake block 108 has all the slope of the wedge on one surface 110, the opposite surface 111 resting against the supporting flange 112 of the casing 24 and moving along the same, in other words the block 108 in this instance instead of moving vertically, as in Fig. 5, moves on a slant to cause the surface 110 to engage the brake surface 63 of the flange 61.

This construction is simpler in certain respects, for example in that the guide pin 113 mounted

in the projection 79 extends parallel to the surface 12, so that the spring 78 in the bore 77 is merely compressed when the brake is applied, and does not also move laterally as in Fig. 5. However, since the spacing between the brake surface of the wedge and the coacting surface of the conical flange is slight, there is very little difference in practical operation of these two forms of brake.

The operation of the grinder will be understood from the structures that have been disclosed. It may be summarized briefly as follows:

The light 36 should be adjusted by bending the flexible conduit 34 to such form that the lamp may be swung to illuminate properly any one of the four grinding positions. Once this adjustment has been made, it will rarely be necessary to bend the conduit 34, thus saving much time and prolonging its life.

The water pot 25, if used, is filled with a suitable coolant, usually water, and inserted in the socket 28 adjacent the grinding wheel which is to be used first.

The work table 12 or 13 is adjusted to the proper angle to suit the angle to be ground on the tool and the table is also adjusted in or out to provide the proper clearance at the side of the abrasive wheel, by manipulating the star wheel 23 and the nuts 91.

The work guiding gage 45 will of course also be adjusted to a suitable angle, if a compound angle is to be produced on the tool, as is often the case. When the upright flange 56 of the gage is inclined at an angle to the guide bar 46, materially smaller than a right angle, the end of the flange 56 will be spaced too far from the grinding wheel to provide sufficient support for the tool at the grinding location, and in such cases the auxiliary tool guide 57 may be used, as already described, to provide better support for the tip of the tool being ground.

Of course what has been said concerning either work table applies also to the remaining one, inasmuch as work tables 12 and 13 are substantially duplicates of one another. When the rough grinding has been finished at one of the wheels, the tool may then be transferred to the work table adjacent the other wheel, the water pot 25 also being shifted to cooperate with the second grinding wheel, and the light 36 likewise being shifted to illuminate the new grinding location.

The motor will be started and stopped and/or reversed as needed by the switch 8. In case reversal of the motor is necessary or desirable in order to facilitate grinding certain surfaces of the tool, time may be saved by using the brakes to prevent the wheels from spinning a long time after the power has been shut off, so that the motor may be reversed without undue loss of time in waiting for the rotation in the first direction to stop.

The water and waste material produced by the grinding will collect in the pan or pans 15, from which it may be discharged by removing the pipe plug 88, unless it is desired to clean the pans 15 more thoroughly, in which case the entire pans as well as the tables carried thereby may be removed by loosening the nuts 91 and merely sliding out the entire assemblies whereupon they may be flushed with clean water to remove all sludge and sediment.

The water pot 25 may likewise be removed bodily for cleaning whenever desired by merely lifting it out, and the ease with which the drip pans 15 and the water pot 25 may be removed and replaced tends to cause the operative to keep these devices clean and free from sludge and rust, which is a great advantage over the customary devices of this kind which can be removed only with some difficulty, and consequently are given thorough cleaning only when they become so clogged that it is essential to do so.

While the invention has been described by reference to a specific example of a machine wherein it is embodied, it is clear that modifications, omissions and additions may be made without departing from the underlying principles involved.

The invention therefore is not to be considered as limited to the specific embodiment disclosed, but its scope is defined solely in the claims.

I claim:

1. A grinder comprising a frame, a shaft carried by said frame, said shaft carrying a flange, and means for rotating said shaft, an abrasive wheel carried by the flange, said flange having a conical surface, a brake shoe mounted in the frame adjacent said flange, and movable in a direction toward and away from the axis of the shaft, said shoe having a wedge-shape whereby it may be forced against the conical surface of the flange by moving it radially inward.

2. A grinder comprising a frame, a shaft carried by said frame, said shaft carrying a flange, and means for rotating said shaft, an abrasive wheel carried by the flange, said flange having a conical surface, and a wedge-shaped brake shoe mounted in the frame adjacent said flange, and manually movable in a direction at an angle to the axis of the shaft, said frame having a guide for said shoe along which it may move, whereby it may be forced against the conical surface of the flange by moving it radially inward.

3. A grinder comprising a frame, a shaft carried by said frame, said shaft carrying a flange, and means for rotating said shaft, an abrasive wheel carried by the flange, said flange having a conical surface, a wedge-shaped brake shoe mounted in the frame adjacent said flange, and manually movable in a direction toward and away from the axis of the shaft, said frame having a guide for said shoe along which it may move, whereby it may be forced against the conical surface of the flange by moving it inwardly, and resilient means opposing inward movement of the shoe, and tending to restore it to its initial position when the manual pressure is discontinued.

4. A grinder comprising an abrasive wheel and means for actuating it, a sludge pan beneath the wheel, said pan having a slotted portion rising above the maximum liquid level of the pan, the base of said slotted portion forming a part of the bottom of said pan and disposed below the liquid level therein, the grinder having a surface fitting against the top of said slotted portion of the pan and closing the tops of said slots, and securing means passing through a portion of the grinder and seated within said slotted portion, for securing the pan to the grinder, whereby the junction between grinder and pan is maintained at a level above any possible level of the liquid in the pan.

5. A grinder comprising an abrasive wheel and means for actuating it, a removable sludge pan beneath the wheel, said pan having a slotted portion rising above the maximum liquid level of the pan, the base of said slotted portion forming a

part of the bottom of said pan and disposed below the liquid level therein, the grinder having a surface slidably fitting against the top of said slotted portion of the pan, means slidably interconnecting said grinder and said slotted portion to constrain the pan to move in a direction parallel to the axis of the wheel, and securing means passing through a portion of the grinder and seated within said slotted portion, for securing the pan to the grinder, said securing means comprising a threaded element bearing against the bottom of the pan, and a work table supported on said pan above the liquid level.

6. A grinder comprising an abrasive wheel and means for actuating it, a pan beneath the wheel, said pan having an elevated portion rising above the maximum liquid level of the pan, the grinder having a surface fitting against the top of said elevated portion of the pan, means for securing the pan to the grinder, said pan having a bearing rising from its bottom, a work table, and a trunnion secured to the underside of said table and mounted for pivotal movement in said bearing, the height of said bearing being sufficient to maintain all parts of the trunnion above the maximum liquid level in the pan.

7. A grinder comprising an abrasive wheel and means for actuating it, a removable sludge pan beneath the wheel, said pan having a slotted portion rising above the maximum liquid level of the pan, the grinder having a surface slidably fitting against the top of said slotted portion of the pan, securing means passing through a portion of the grinder and seated within said slotted portion, for securing the pan to the grinder, a work table, trunnions secured to the underside of said table, bearings for said trunnions, said bearings rising from the pan to a height sufficient to maintain the trunnions above said maximum liquid level, and screw threaded means coacting with said bearings and trunnions, to secure them in any desired relative adjustment.

8. A water pot for a grinder having a frustoconical lug extending downwardly therefrom and adapted to seat in a correspondingly shaped socket in the grinder to maintain the water pot frictionally in position, while facilitating its removal at will, said lug and socket having a comparatively small degree of taper, and adapted to be brought into intimate engagement, whereby the weight of said pot will establish a sufficiently strong frictional connection between said tapered surfaces to maintain said pot in fixed angular position on said grinder.

9. In a grinding apparatus, a grinder structure; a shaft mounted for rotation in said grinder structure; abrasive wheels mounted on the opposite ends of said shaft; means for rotating said shaft, each wheel having two grinding stations, one each side of the vertical plane of said shaft, said four grinding stations being substantially equidistant from the axis of the grinder; and illuminating means, comprising a lamp and an arm carrying said lamp; means supporting said arm for rocking movement about a substantially vertical axis located closely adjacent the vertical plane of said shaft and disposed substantially intermediate said wheels and the grinding stations thereof, whereby said lamp may be horizontally swung into any of said grinding stations at will.

10. A grinder comprising a motor having a shaft carrying an abrasive wheel at each end thereof; a shaft-supporting end frame adjacent each of said wheels, bearings for said shaft mounted in said end frame; a water pot; means for selectively holding said pot removably on either one of said end frames, comprising an upwardly facing socket in each of said frames adjacent said wheels and a downwardly directed post on said water pot, said sockets being of similar size and shape and adapted to interchangeably receive said post; a pair of pans for catching water draining from said wheels; means for securing said pans to said frames; and a work table mounted on each of said pans adjacent said wheels.

11. A motor end frame for a grinder, having a cylindrical portion adapted to fit against the stationary motor field structure, said end frame carrying a shaft bearing, said end frame also having an upper arcuate portion constituting a wheel guard and a lower flat surface constituting a clamping surface for a sludge pan, a brake shoe slidably mounted in said frame for movement toward and away from the axis of said shaft bearing and projecting through an opening in said frame; and an inclined guide in said frame for causing said brake shoe to undergo a combined axial and radial movement when it is moved inwardly.

12. In a grinding apparatus having a wheel rotatable about a horizontal axis and journalled in a grinder frame, said grinder frame having an axially directed flange located below said wheel and providing a substantially flat, downwardly facing clamping surface; a coolant receiving pan having a raised marginal edge and a boss disposed within the raised edge and terminating above the level of the raised edge in an upwardly facing clamping surface; means for securing said pan to said flange, with said clamping faces in frictional engagement, said means being adjustable so as to allow said pan to be moved horizontally relatively to said flange, in a direction parallel to the axis of said wheel; and a work table supported on said pan within the marginal edge thereof, in cooperative relationship to said wheel and adapted to be bodily adjusted toward and away from said wheel when said pan is adjusted parallel to the axis.

13. The grinding apparatus defined in claim 12, wherein said pan is provided with a pair of raised portions disposed either side of said boss, and each raised portion has an arcuate, upwardly facing seat disposed above the level of the raised marginal edges of said pan, and said table has mating arcuate portions supported on said seats, and means are provided for detachably securing said table to said pan, with said arcuate seats and said mating arcuate portions in frictional locking engagement.

14. The grinding apparatus defined in claim 12, wherein said means for securing said pan to said flange comprises a plurality of vertically disposed threaded fastening elements passing through openings in said flange and through axially extending slots in said pan, said slots opening onto the upwardly facing clamping surface of said boss above the coolant level, thereby precluding leakage of coolant from said pan.

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