Feb. 26, 1946. B. TOCCI-GUILBERT 2,395,519

SURFACE GRINDER

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Fig. 1

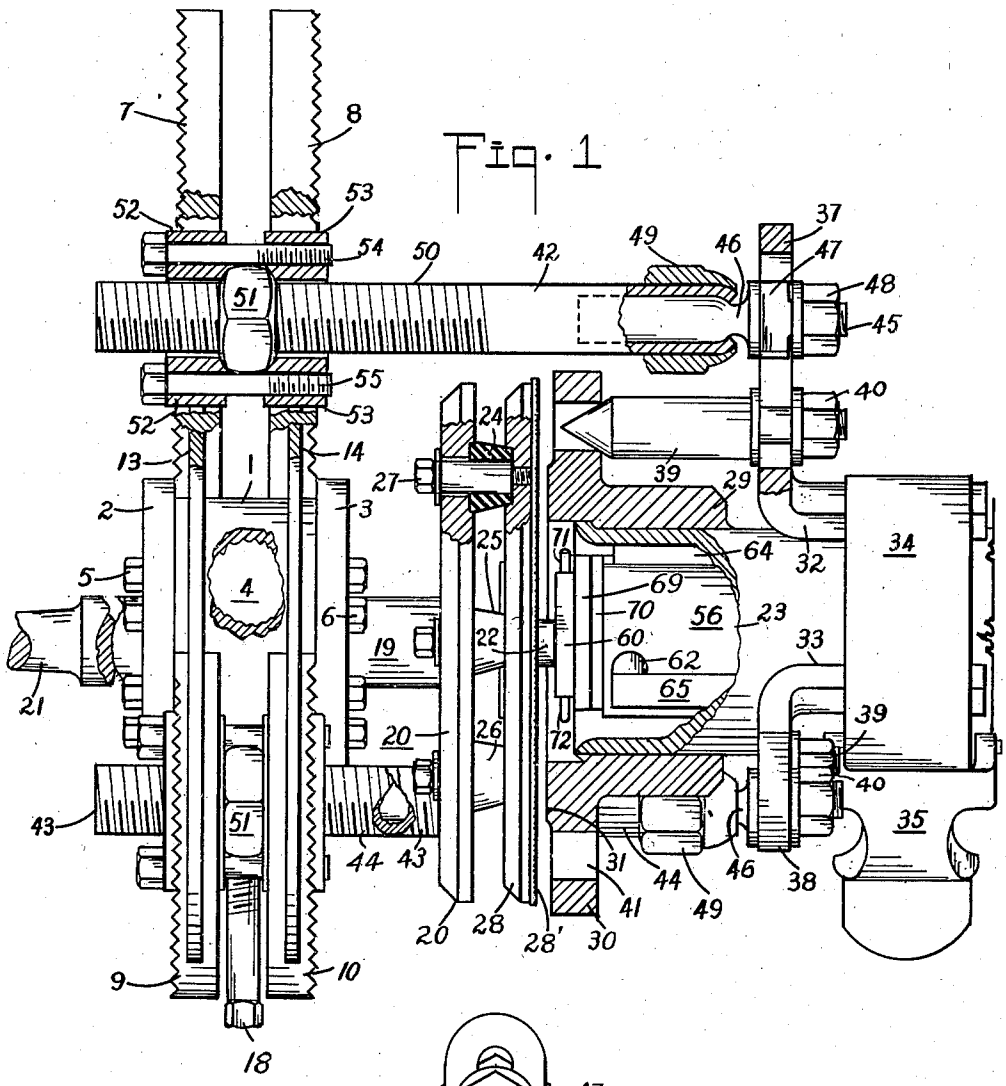
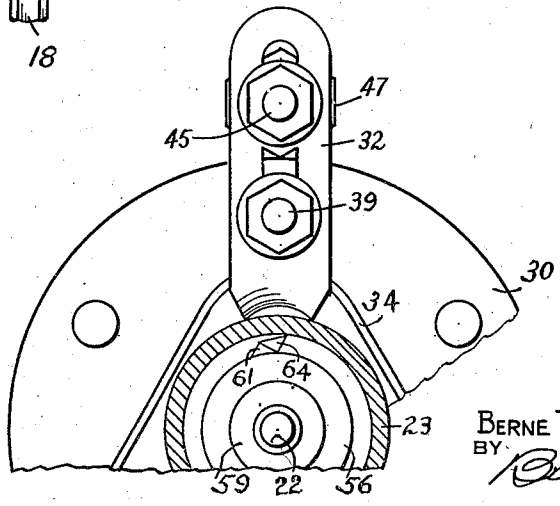


Fig. 3



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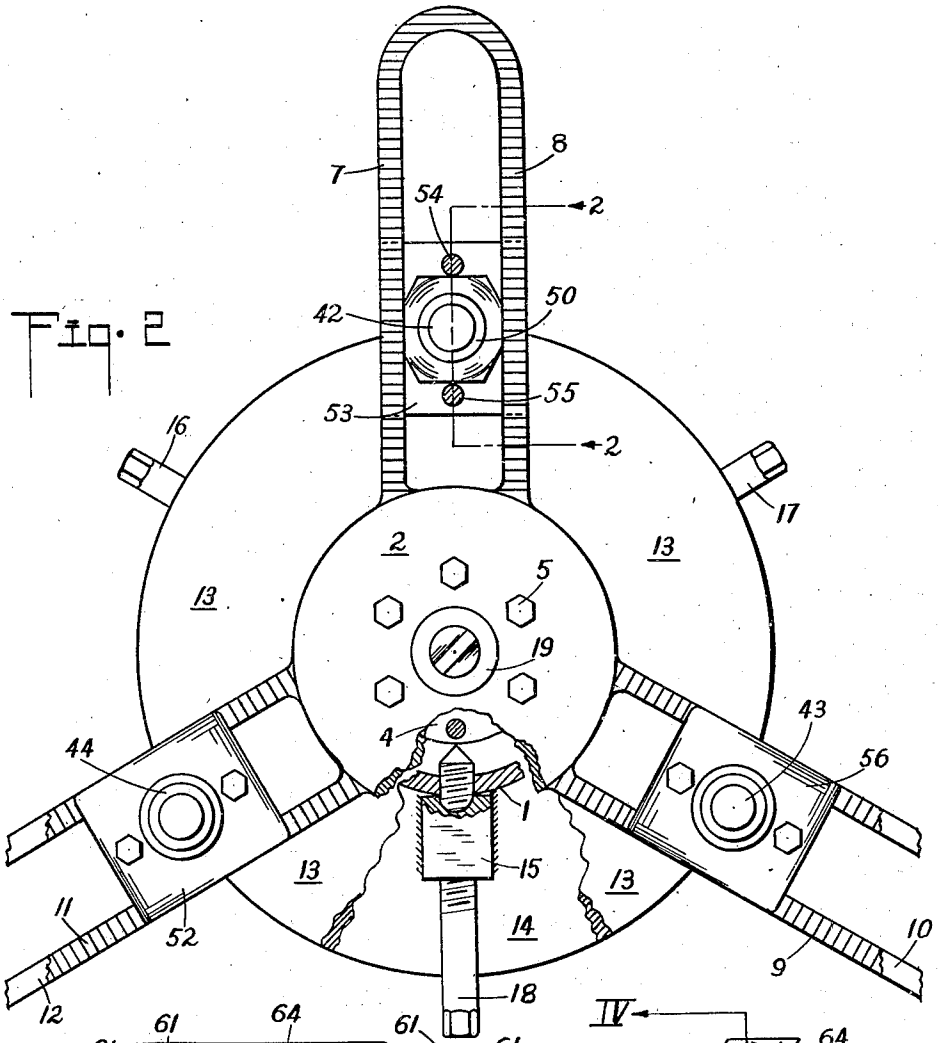
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SURFACE GRINDER

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Fig. 2



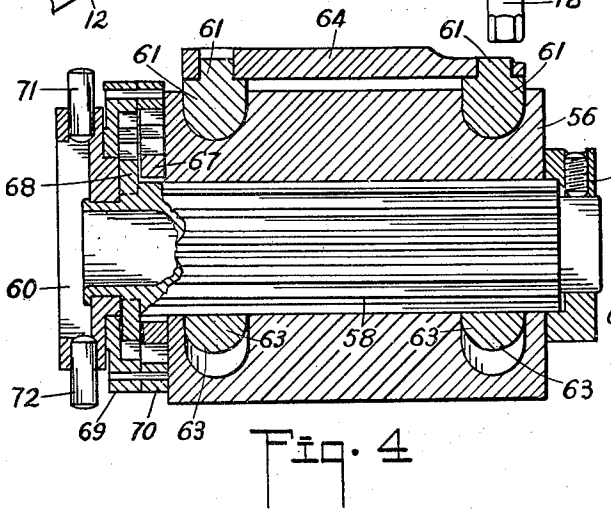


Fig. 4

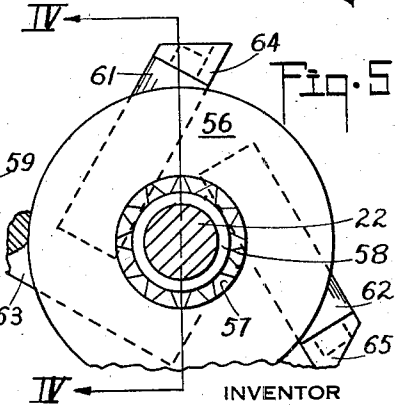


Fig. 5

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SURFACE GRINDER

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Fig. 6.

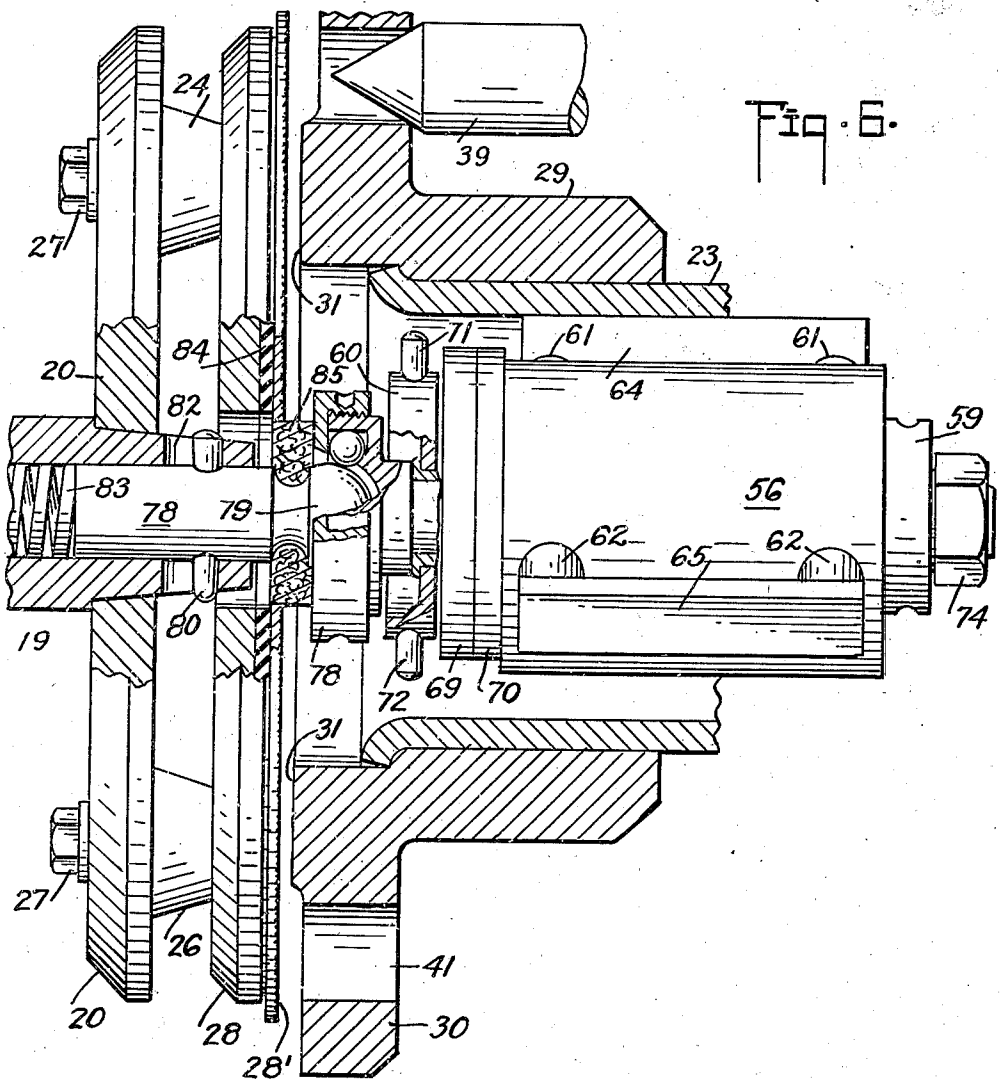
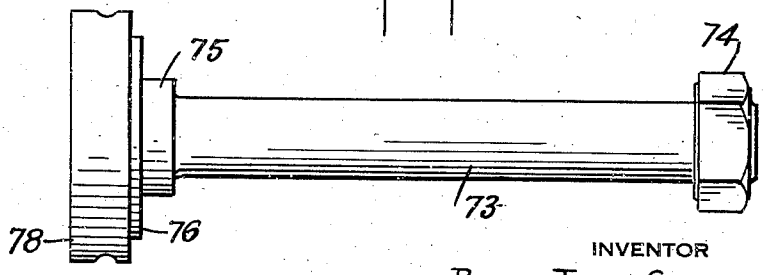


Fig. 7.



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UNITED STATES PATENT OFFICE

2,395,519

SURFACE GRINDER

Berne Tocci-Guilbert, San Francisco, Calif.

Application March 2, 1945, Serial No. 580,546

14 Claims. (Cl. 51—241)

This invention relates to surface grinders and more particularly to machines for finishing the meeting faces of flanges on high pressure pipes.

Among the objects of the invention is the provision of simple and portable means for reducing the meeting planes of pipe flanges to a degree of tolerance where they become self sealing against high fluid pressures.

Another object is the elimination of interposed gaskets in flange joints.

Another object is the reduction of time necessary to completely finish a flange.

Further objects are, improving the quality of the finish, reducing the skill necessary and enlarging the use of finished flanges by cutting the incidental cost.

Other objects and advantages will appear as the description proceeds.

In joining pipes having end flanges it is important that the plane of the meeting faces of the flanges be perpendicular to the axis of the joint to avoid lateral stresses when the flanges are drawn together by bolts and when the pipe line is distorted by variations in internal pressure. High pressure steam lines may carry internal pressures up to one thousand pounds pressure per square inch or more; under conditions where compressible gaskets are impracticable, because they double the meeting area and the blow out hazard. Practically no tolerance is permissible in the meeting areas of the flange faces, to seal the internal pressure and withstand the effects of thermal expansion, contraction and vibration.

With this invention it is possible for a skilled mechanic to finish a flange of practically any dimension in a few minutes. The machine is light, portable and easily adjusted, making it possible to resurface a defective joint at sea or away from repair shops. This is a valuable consideration on board vessels at sea, especially in war time where every minute of immobility is a service hazard.

In the specification and drawings the invention is disclosed in its preferred form. But it is to be understood that it is not limited to this form, because it may be embodied in modifications within the spirit of the invention as defined in the claims following the description.

In the three sheets of drawings:

Fig. 1 is a side elevation, partially in vertical section, of a flange grinder constructed in accordance with this invention.

Fig. 2 is a front elevation of the same.

Fig. 3 is a detail in rear elevation of the pipe anchor dog.

Fig. 4 is an enlarged detail in longitudinal section of the pilot chuck bearing, taken on the line IV—IV, Fig. 5.

Fig. 5 is an end view of the same, with the assembling collar omitted to disclose the axial pinion.

Fig. 6 is an enlarged detail in side elevation similar to Fig. 1, showing a modified form of pilot bearing for the reduced end of the driven shaft.

Fig. 7 is a detail in side elevation of the removable pilot bearing.

In detail the structure shown in Fig. 1, comprises the main bearing housing ring 1, with the end plates 2, 3, welded thereto. The main bearing 4 is centered and held in position by the series of cap screws, such as 5, 6, through their respective plates and threaded in the ends of the bearing 4. This bearing has an interliner holding a replaceable pin, roller, ball or other type of conventional antifriction bearing, not shown.

The looped brackets 7—8, 9—10, 11—12, are arranged in pairs radiating from and welded to the periphery of the ring 1. These brackets are braced by interposed segmental shrouds, such as 13, 14, welded to the periphery of the ring 1 and the contiguous brackets. Intermediate the pairs of brackets, the blocks, such as 15, see Fig. 2, are welded to the shrouds 13, 14 and threaded to receive the adjusting screws 16, 17, 18 respectively. These screws bear against the main bearing 4 for adjusting the axis of this bearing relative to the housing 1.

The driven shaft 19 revolves within the main bearing 4 and has the circular head 20 fixed on its inner end. The outer end 21 is finished in a morse taper or otherwise, for the application of driving power to this end of the shaft. The inner end is reduced in diameter at 22 and projects beyond the head 20, into a clutch bearing fixed in the pipe 23, Fig. 1.

The head 20 is provided with an annular series of cushions 24, 25, 26, fastened to the head by the bolts 27. The facing head 28 with the grinding disc 28' thereon, slidably engages the pilot shaft end 22 and revolves with the head 20 and is resiliently driven by the bolts 27 and cushions 24—26.

The pipe 23 has the flange hub 29 beaded and welded thereon or otherwise attached, the annular flange 30 is integral with the hub and has the raised annular area or face 31 coplanar with the disc 28'.

The three angular dogs, such as 32, 33 are clamped to the periphery of the pipe 23 by the clamp strap 34 having the handle 35 by means of which the strap is drawn taut to hold the

dogs in firm contact with the pipe. These dogs have the lateral extensions such as 37, 38 respectively, and arranged in spaced alinement with the several groups of looped brackets 7—12. Each of the extensions 37, 38 is slotted to receive the ends of the pointed studs such as 39, adjustably fixed to the extensions by the nut 40 threaded thereon so that the pointed end of the studs can extend into the holes 41 in the flange 30, or against the back of the flange intermediate these holes.

Each of the threaded spindle assemblies 42, 43, 44 are alike in structure and mode of operation, it is deemed sufficient to describe but one in detail. The stud 45 extends well into the spindle and has the neck 46 around which the inner end of the spindle turns freely. This stud has a base flange overhanging the slot in the extension 37, with the flat portion 47 slidable in the slot to prevent the stud turning in the slot when the nut 48 is set tight. The hexagonal wrenchhold 49 encircles and is welded to the clinched end of the spindle, reinforcing it against the withdrawal of the stud at the neck 46 when tension is applied to the spindle.

The outer end portion of the spindle is threaded at 50 and passes through the running nut 51 threaded thereon. This nut is clamped between a pair of ratchet blocks such as 52, 53, each having notched portions overhanging and engaging the notched edges of their respective looped brackets 7, 8, into which they are locked by their connecting cap screws 54, 55. This permits free lateral adjustment of the spindle 42, relative to the diameter of the flange 30. By applying a wrench to the wrenchhold 49 the spindle may be advanced or retracted through the running nut 51, held against rotation between the contacting cap screws 54, 55. By similarly turning all the spindles the distance between the main bearing 1 and the pipe flange 30 may be adjusted and this bearing held rigidly in position relative to the pipe 23, by the tension of the spindles applied to the studs such as 39, engaging the flange 30.

When the main bearing 1 is alined with the pilot clutch bearing 56 in the end of the pipe 23, the pilot end 22 of the shaft 19 revolves freely therein and has a free longitudinal movement to bring the grinding disc 28' into grinding contact with the flange face 31.

The clutch bearing comprises the solid cylindrical body 56 having the axial center bore 57 within which the long pinion 58 revolves freely, see Figs. 4, 5. The rear end of this pinion is reduced and has the set collar 59 fixed thereon. The front end is similarly reduced to receive the adjusting eccentric 60 clinched thereon but revolving freely. The pinion 58 is longitudinally bored to provide a bearing for the pilot end 22 of the drive shaft 19.

The body 56 is provided with three pairs of alined tangential bores to receive the rackrods 61, 61, 62, 62, 63, 63. These several pairs of rods are joined at their tops by the longitudinal jaws 64, 65, 66 respectively, 66 being broken away. Each rod is provided with rack teeth enmeshed with the pinion 58 and are advanced and retracted by manually rotating the pinion.

The pinion 58 is actuated through a train of encyclic or planetary gears consisting of the stationary annular spur gear 67 fixed on the end of the body 56 coaxially with the pinion 58 and the similar gear 68 fixed upon and rotating with the pinion 58, contiguous to the eccentric 60. The internal gear 69 is mounted freely upon the hub of the eccentric 60 and meshes with and gyrates around the spur gear 68. The internal gear 70 meshes with and gyrates around the fixed spur gear 67 on the body 56. The internal gears 69, 70 are pinned together and gyrate in unison, but they differ slightly in pitch diameter and the teeth in the gear 69 differ from 70 in circumferential spacing. This causes a locking effect so that the pinion 58 is always locked against rotation except by rotating the eccentric 60 by a spanner engaging the studs 71, 72.

When the eccentric 60 is rotated on the axis of the pinion 58, it causes the pair of gears 69, 70 to gyrate around the fixed gear 67. The gear 68 being the only free gear in the train, reacts to the rotation of the eccentric 60 to rotate the pinion 58, which advances or retracts the rack rods 61—63 and the jaws 64—66 thereon. This enables the chuck bearing 56 to be securely fixed within the tube 23 for providing a bearing for the pilot shaft end 22, see Fig. 1. These alined bearings 4 and 56 are important in maintaining the axis of the shaft 19 perpendicular to the plane of the flange face 31, during the application of power to the shaft 19.

This invention operates substantially as follows: The pipe 23 is first securely fastened to a bench, the bed of a drill press or any other suitable position against movement when power is applied. The chuck bearing 56 is then inserted into the pipe 23 and the eccentric 60 rotated until the three jaws such as 64—66, are advanced to firmly engage the inner diameter of the pipe 23.

The main bearing assembly 1—55 is then manually held in the position shown in Fig. 1 with the pilot shaft 22 within the center bore of the pinion 59. The several dogs such as 32 are then swung into position around the pipe 23 and loosely held by the strap 34 while the whole assembly is moved forward until the several studs 39 enter the rear of the holes 41 in the pipe flange. The handle 35 is then advanced to tighten the strap 34.

The several spindles 42—44 are then rotated in their respective nuts 51, by the wrenchholds 49, until the grinding disc 28' is in proper operating proximity to the face 31 of the flange. The cap screws 54, 55 in the several blocks 52, 53 are tightened to lock the spindles in adjusted position on the loops 7—12. When necessary the several adjusting screws 16—18 can be used to move the main bearing 4 into perfect axial alinement with the chuck bearing 56 in the pipe 23.

To accommodate the larger sizes of pipes and flanges, the cap screws 54, 55 in all the looped brackets 7—12 are loosened and the blocks 52, 53 in all these brackets are advanced or retracted according to the diameter of the flange 30 and again tightened to cause the teeth in the overhanging edges of these blocks to lock into the similar teeth in the faces of the several brackets 7—12 respectively. The studs 39 can be laterally adjusted in their several dogs, such as 37, 38 to meet lateral variations in the positions of the flange holes 41.

When the whole apparatus is thus rigidly positioned on the pipe 23, power is applied to the shaft end 21, and manual pressure is applied to the primemover, not shown, to advance and retract the grinding disc 28' with respect to the flange face 31. If this face is unusually rough or not truly perpendicular to the axis of the pipe 23, a relatively coarse grinding disc 28' is used first to grind away the face 31 to the proper condition, after which a finer grit disc can be

substituted, and the grinding continued until the face 31 assumes the proper texture to accomplish perfect planar contact with a similar face on the opposing flange not shown, to which it is bolted in the usual manner.

A very high polish is not desirable, it is preferable that microscopic rugations exist that will be flattened to a common plane between the meeting faces 31, when drawn together by the bolts acting through the flange holes 41.

The operative procedure is to gently force the disc 28' against the face 31, then gently decrease the pressure slightly and intermittently. This causes a gyratory action due to the yielding compression and expansion of the cushions such as 24, 25, 26, dispersed concentrically between the driving head 20 and the driven head 28. This slight deviation from the true circle of action prevents the formation of concentric scratches in the face 31, also enables the escape of grit particles by centrifugal force from between the opposing surfaces 28', 31, that could otherwise pile up and unevenly score the face of the flange.

The ultimate finish shows a homogeneous texture with neither concentric nor radial scoring, but rather a uniformly ground surface with little or no perceptible design therein. Such a condition can only be attained by the previous practice of manually scraping and then honing the surface 31, with great manual skill and the labor of many hours and often days on the larger flanges.

The interposition of the cushioning element such 24—26, between the grinding disc 28' and the application of power thereto, is largely responsible for the speed with which the ultimate object is accomplished. In that deep scoring of the flange is practically impossible because of the cushioning effect and the chafing or rubbing resulting from deviations, however slight, from the concentric toward the eccentric travel of the grinding surface. This resiliency also minimizes to a large degree any lack of skill in the operator. It has the further advantage of compensating for any differential in the perpendicularity of the axis of the shaft 19 to the plane of the flange face 31.

Any flat surface can be ground in like manner by substituting it in the same relative position to that of the flange face 31, shown in Fig. 1, by omitting the chuck bearing 56, if not required, without departing from the spirit of the invention.

There are occasional instances where the plane of the flange face 31 is askew relative to the axis of the pipe 23, to such an extent that the rigid pilot shaft 22 bearing in the center bore of the pinion 58, will not permit the necessary angular adjustment of the head 28 to the plane of the face 31.

The modified bearing shown in Fig. 7, comprises the bolt 73, having the nut 74 threaded thereon. The opposite end of this bolt has the head 75 with the annular ball race 76 for the ball bearing 77. The ball retainer 78 is in the form of a cap threaded on the periphery of the ball race 76.

The pilot plunger 78, has the spherical head 79 thereon and bearing against the ball race 77 forming in effect a ball and socket. The pilot plunger 78 is freely slidable within a center bore in the end of the driven shaft 19. The taper pin 80 is fixed transversely in this plunger and slides in the slot 82 formed longitudinally in the end of the drive shaft. The inner end of the plunger bears against the expansion spring 83 within the center bore in the driven shaft and expands against the bottom of the bore. The expansion of the spring is stopped by the taper pin 80 in the slot 82.

The spherical head 79 revolves within the ball race 77 fixed within the chuck bearing 56, by the bolt 73, passing through the center bore therein and held by the tension of the nut 74, bearing against the outer end of the hollow pinion 58, and pulling the head 75 firmly against the inner end of this pinion.

Referring to Fig. 1, the axis of the driven shaft 19 is adjusted by turning one or more of the threaded spindles 42—44 within their respective nuts 51, to bring the planes of the grinding disc 28 and the face 31 of the flange, into parallelism. The spherical head 79 will give a true guiding pivot within the ball race 77, at any adjusted angle given the axis of the driven shaft 19, relative to the axis of the pipe 23.

In using coarse grit grinders at 28', there is a tendency for the grinder to grab and score the flange face 31. This tendency is counteracted by the spring 83, the tension of which must be overcome by the manual pressure applied, as previously described. The action of this spring is further advantageous in polishing the face 31 with the finer polishing discs at 28', enabling a better controlled manual pressure, and rubbing action due to the resilient mounting of the head 28 on the cushions at 24, 25, 26.

The rubber insert disc 84 in the face of the head 28 gives better frictional drive to the grinding disc 28'. The soft felt washer 85, forced over the spherical head 79 prevents the grinding grit from entering the ball race 77.

Having thus described this invention and its mode of operation what is claimed and desired to secure by Letters Patent is:

1. A flange grinder comprising a supporting frame externally attachable to a pipe having a flange thereon; a shaft rotatable in said frame and alined with the axis of said pipe and having a grinding surface thereon substantially parallel with the plane of said flange.

2. A flange grinder comprising a supporting frame externally attachable to a pipe having a flange thereon with holes therethrough; studs on said frame engaging said holes; a shaft alined with the axis of said pipe and mounted in a bearing in said frame; and a grinding head resiliently mounted on said shaft and substantially coplanar with the face of said flange.

3. A flange grinder for pipes having flanges thereon, comprising a frame attachable to said pipe and supporting a bearing substantially in axial alinement with said pipe; a shaft in said bearing having a driven head thereon; a grinding head substantially coplanar with the face of said flange and loosely attached to said driven head; and cushioning means interposed between said driven head and said grinding head.

4. A flange grinder for pipes having flanges thereon; a plurality of dogs externally engaging said pipe behind said flange; a series of spindles arranged around said flange and engaging said dogs; brackets longitudinally adjustable on said spindles and supporting a bearing substantially in axial alinement with said pipe; a shaft in said bearing and having a grinding head thereon substantially parallel with the face of said flange.

5. A flange grinder for pipes having flanges thereon, comprising a plurality of dogs externally attachable to said pipe and having slotted extensions behind said flange; studs adjustable in said

extensions; spindles arranged around the circumference of said flange and swiveled to said studs; brackets longitudinally adjustable on said spindles and supporting a bearing in substantial axial alinement with said pipe; a shaft in said bearing and having a grinding head thereon and substantially parallel with the face of said flange.

6. A flange grinder for pipes having flanges thereon, comprising a plurality of dogs externally attachable to said pipe and having slotted extensions behind said flange; studs adjustable in said extension and engaging behind said flange; threaded spindles arranged around the circumference of said flange and rotatably supported by said extensions; a bearing having brackets with threaded members engaging said spindles; and a shaft in said bearing with a grinding head thereon substantially parallel with the face of said flange.

7. A flange grinder for pipes having flanges thereon, comprising a plurality of rotatable spindles having means for engaging said pipe behind the flange thereon; a bearing having radial brackets extending on the opposite sides of said spindles respectively and having notched opposed edges; blocks interposed in said brackets and engaging said notches; running nuts on said spindles and locked between said blocks respectively; and a shaft in said bearing and having a grinding head thereon substantially parallel with the face of said flange.

8. A flange grinder for pipes having flanges thereon, comprising a chuck bearing adapted to be fixed within said pipe adjacent said flange; a frame attachable to said pipe and supporting a main bearing in axial alinement with said chuck bearing; a shaft in said main bearing and having a pilot end extending into said chuck bearing; a grinding head on said shaft substantially coplanar with the face of said flange.

9. A flange grinder for pipes having flanges thereon, comprising a chuck bearing adapted to be fixed within said pipe adjacent said flange; a plurality of rotatable spindles having means thereon for engaging said pipe behind the flange thereon; a main bearing having radial brackets adjustably engaging said spindles respectively; blocks on said brackets in threaded engagement with said spindles; a shaft rotatable in said main and chuck bearings; and a grinding head resiliently mounted on said shaft substantially coplanar with the face of said flange.

10. A grinder for flat surfaces, comprising a frame held in fixed relation to said surface; a bearing mounted in said frame; a shaft rotatable in said bearing perpendicular to said surface; a driven head fixed on said shaft; a grinding head loosely attached to said driven head; and resilient cushions interposed between said driven and grinding heads.

11. A flange grinder for pipes having flanges thereon, comprising a chuck adapted to be fixed within said pipe adjacent said flange and having a socket bearing therein; a frame mounted on said pipe and adjustable relative to the plane of the flange on said pipe and supporting a main bearing; a driven shaft in said main bearing and having a spherical end extending into said socket bearing; a grinding head on said driven shaft substantially coplanar with the face of said flange.

12. A flange grinder for pipes having flanges thereon, comprising a chuck adapted to be fixed within said pipe adjacent said flange and having a socket bearing therein; a frame mounted on said pipe and flange assembly and adjustable relative to the plane of the flange on said pipe and supporting a main bearing; a driven shaft in said main bearing; a plunger slidable in a center bore in the end of said driven shaft and having a spherical head extending into said socket bearing; a spring in said center bore and bearing against said plunger; a grinding head on said driven shaft substantially coplanar with the face of said flange.

13. A flange grinder for pipes having flanges thereon, comprising a chuck adapted to be fixed within said pipe adjacent said flange and having an antifriction bearing thereon; a frame mounted on said pipe and flange assembly and adjustable relative to the plane of the flange on said pipe and supporting a main bearing; a driven shaft in said main bearing and having a center bore in the end thereof; a plunger slidable in said center bore and having a spherical head extending into said antifriction bearing; a transverse pin through said plunger and slidable in a slot in said driven shaft; a spring in said center bore expanding against said plunger; a grinding head on said driven shaft substantially coplanar with the face of said flange.

14. A flange grinder for pipes having flanges thereon, comprising a chuck adapted to be fixed within said pipe adjacent said flange and having an antifriction bearing therein; a frame mounted on said pipe and flange assembly and adjustable relative to the face of the flange on said pipe and supporting a main bearing; a driven shaft in said main bearing and having a center bore in the end thereof; a plunger slidable in said center bore and having a spherical head extending into said antifriction bearing; a spring in said center bore expanding against said plunger; a dust guard washer on said plunger behind said head and closing the opening to said antifriction bearing; and a grinding head on said driven shaft substantially coplanar with the face of said flange.

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