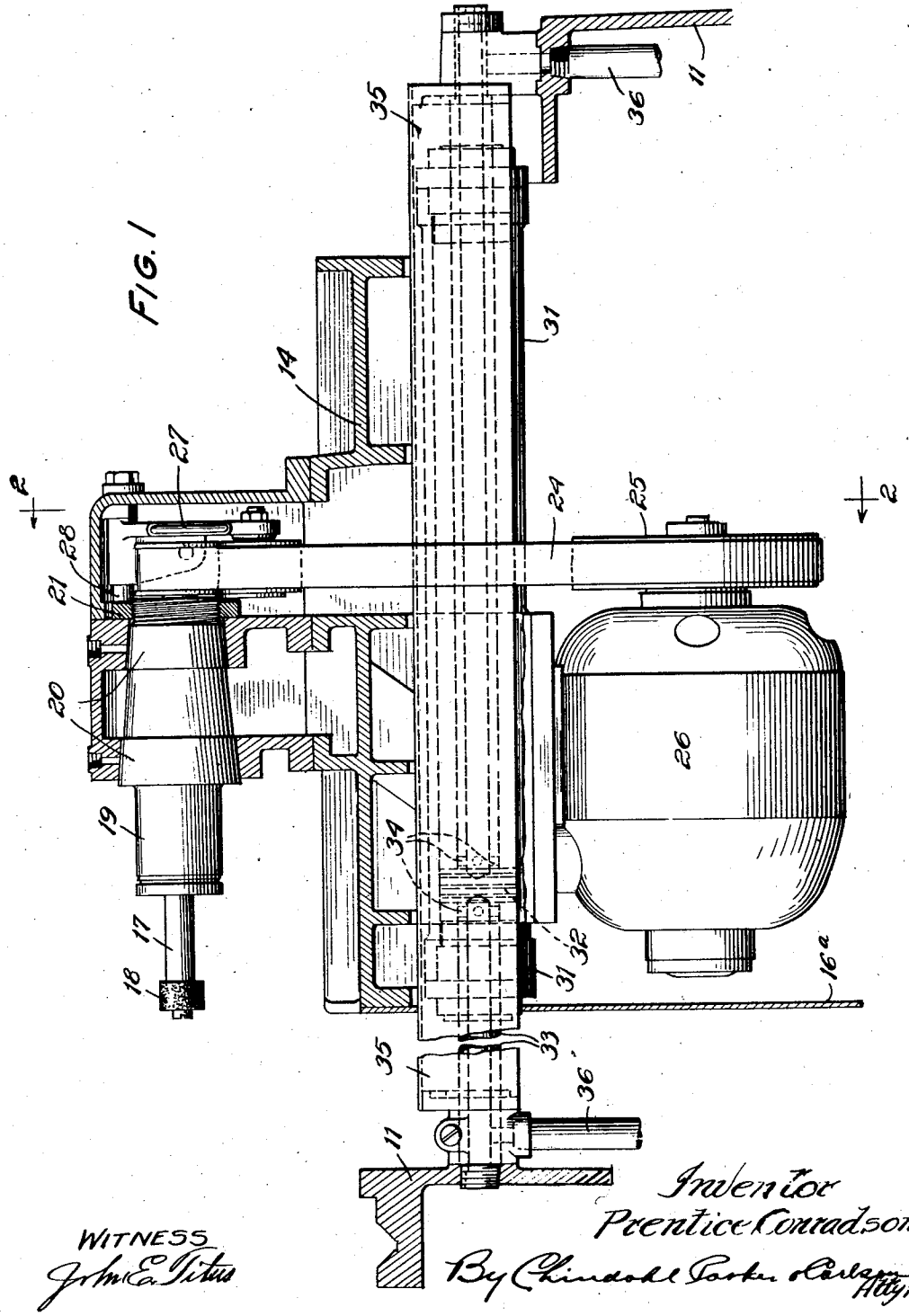
Dec. 18, 1928. 1,695,759

P. CONRADSON

GRINDING MACHINE

Filed Feb. 15, 1923 3 Sheets-Sheet 1

FIG. 1



WITNESS
J. M. E. Titus

Inventor
Prentice Conradson
By Chisholm Parker & Carlson Attys

Dec. 18, 1928. 1,695,759

P. CONRADSON

GRINDING MACHINE

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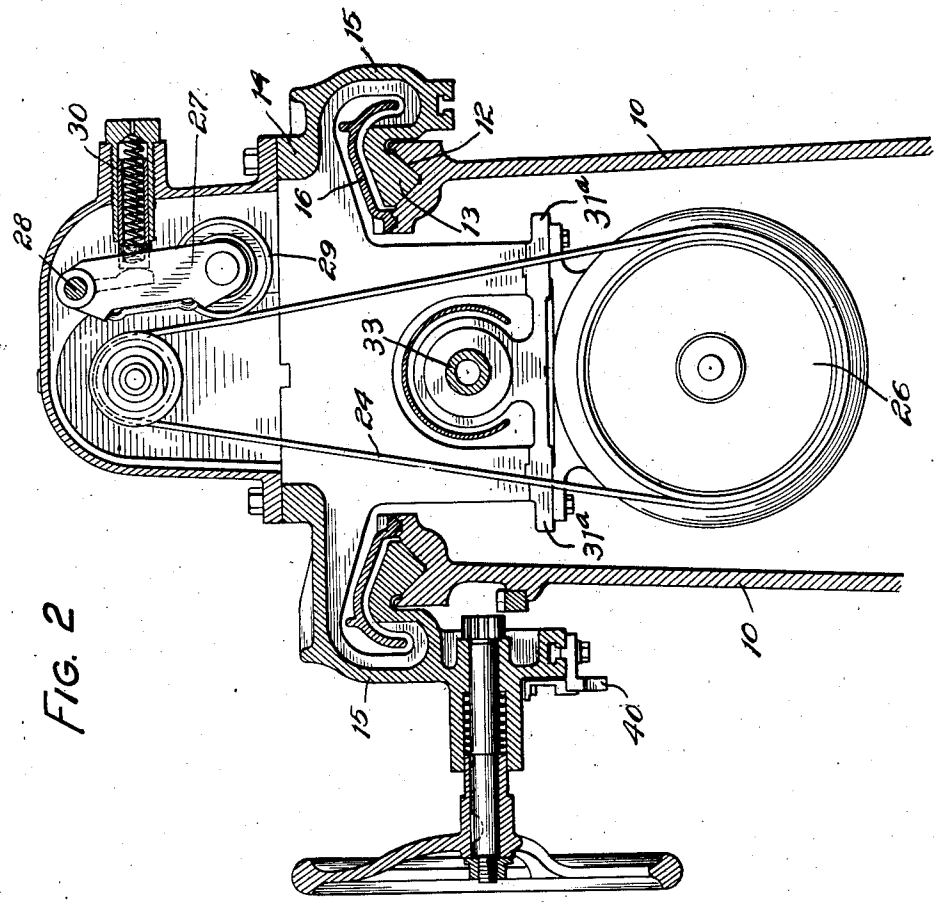


FIG. 2

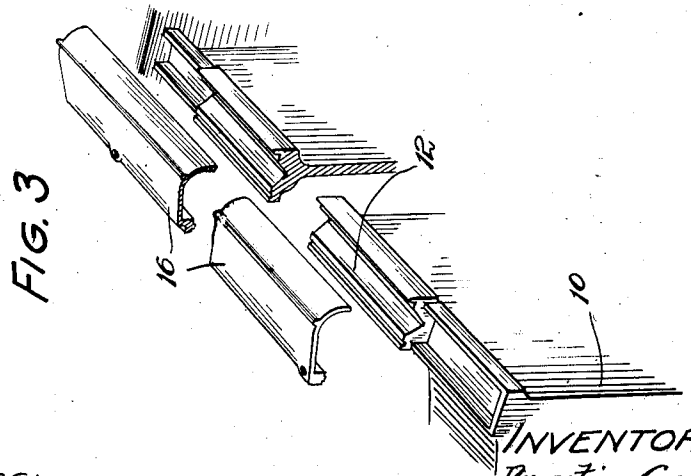


FIG. 3

WITNESS:
John A. Vitus

INVENTOR
Prentice Conradson
By Clindahl Parker & Carlson
Attys

Dec. 18, 1928. 1,695,759

P. CONRADSON

GRINDING MACHINE

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FIG. 4

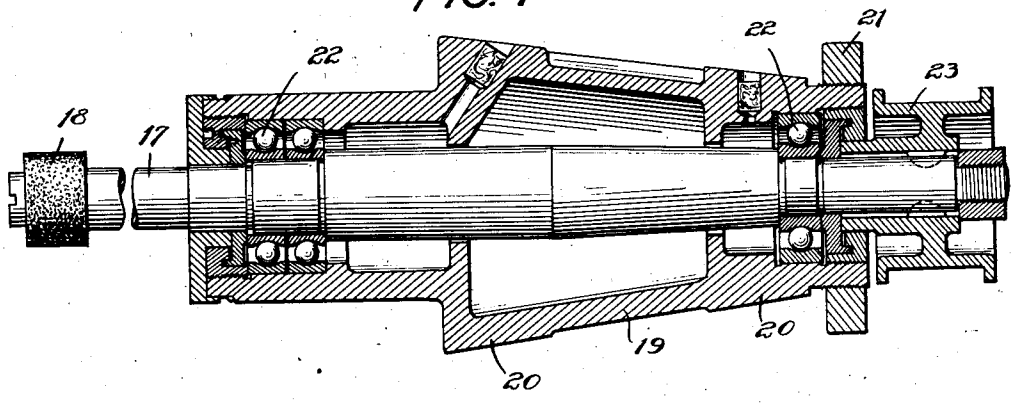
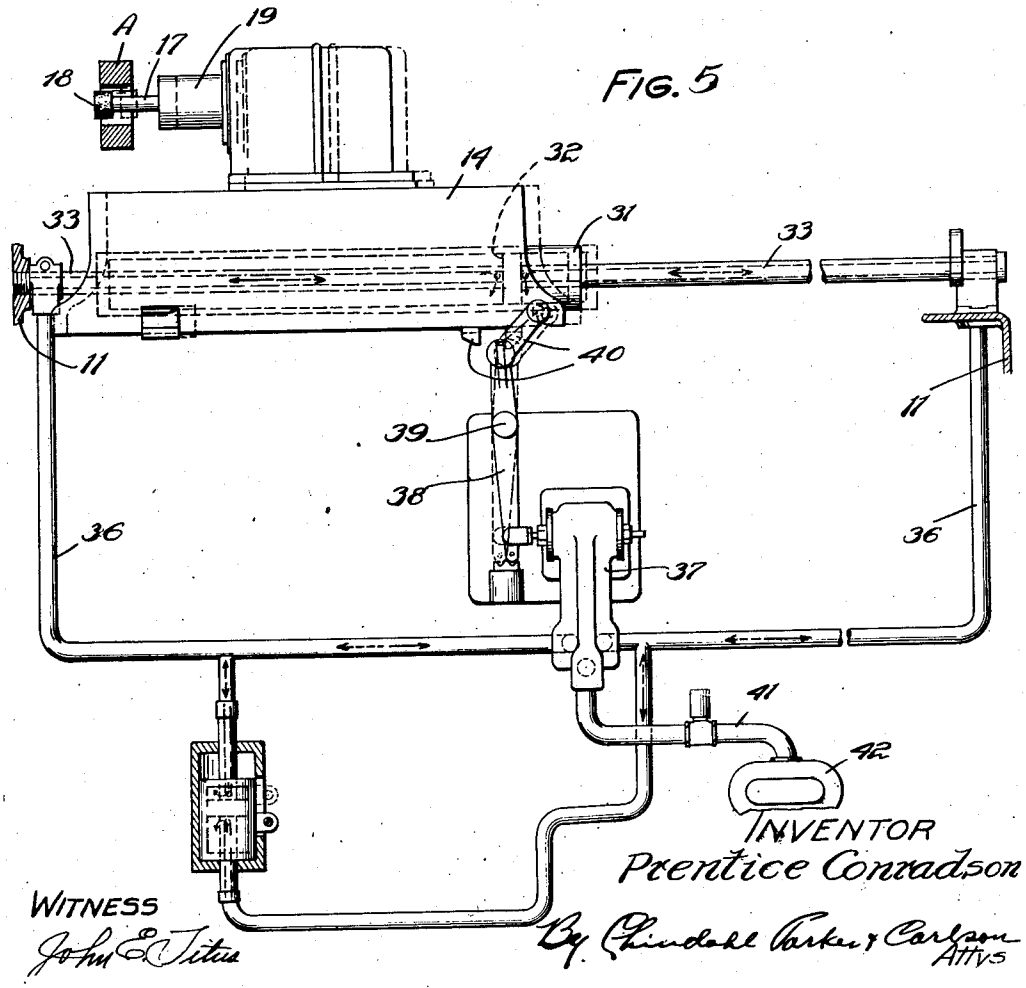


FIG. 5



INVENTOR
Prentice Conradson

WITNESS
John E. Titus

By Rhindall Parker & Carlson
Attys

Patented Dec. 18, 1928. 1,695,759

UNITED STATES PATENT OFFICE.

PRENTICE CONRADSON, OF EVANSVILLE, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE HEALD MACHINE COMPANY, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

GRINDING MACHINE.

Application filed February 15, 1923. Serial No. 619,124.

This invention relates to a grinding machine of the type which is more fully disclosed in my copending application Serial No. 619,122 filed February 15, 1923 and the invention relates more particularly to improvements in the grinding spindle carriage and the manner of mounting and operating the same.

In prior machines of this character the spindle has usually been driven by means of a belt running over a long driving drum, the belt traveling along the drum to follow the movements of the carriage. This type of drive is objectionable because it subjects the belt to great strain and wears it rapidly. It is one of the objects of my invention to produce an improved carriage and spindle-driving means which eliminates the difficulties of this prior arrangement and greatly increases the life of the belt; in which the weight of the carriage is balanced and distributed in a way to minimize vibration; in which all overhead driving belts are dispensed with; which provides a very compact and unitary construction; and in which the driving motor and driving connections are enclosed within the machine so as to be entirely out of the way.

I accomplish these objects by mounting the driving motor on the underside of the carriage beneath the spindle of travel with the carriage, the motor and driving connections being enclosed by the machine base and the carriage housing.

Another object of the invention is to produce an improved carriage which is of a very simple and durable construction so that it may be operated satisfactorily at high reciprocating speeds and embodies no devices which are apt to get out of order or cause trouble in use, and to this end the carriage is provided with improved means which operates hydraulically to reciprocate the carriage.

Another object is to produce a carriage which combines the said driving means and reciprocating means in a unitary compact structure.

A further object is to provide improved means for guarding or protecting the carriage ways against grit, water, or other foreign substances.

In the acompanying drawings, Fig. 1 is a view partially in elevational and partially in longitudinal vertical section through a grinding machine embodying the feature of my invention.

Fig. 2 is a transverse vertical section taken in the plane of line 2—2 of Fig. 1.

Fig. 3 is a perspective view somewhat diagrammatic illustrating the means for guarding or protecting the supporting ways for the carriage.

Fig. 4 is an axial section through the grinding spindle and its bearings.

Fig. 5 is a diagrammatic view showing the carriage in side elevation and the hydraulic means for operating the carriage.

While my invention is susceptible of various modifications I have shown in the drawings, and will herein describe in detail, the preferred embodiment, but it should be understood that I do not thereby intend to limit the invention to the exact construction disclosed but aim in the subjoined claims to cover all modifications and alternative constructions falling within the scope of the invention.

The machine shown in my copending application above referred to, and of which the present carriage forms a part, is specially adapted for internal grinding and comprises a bed or base, a head stock having a rotary spindle provided with a chuck or fixture for holding the work to be ground, and a carriage mounted on ways on said bed to reciprocate longitudinally of the bed toward and away from the head stock. The carriage has a spindle with a grinding wheel thereon to enter the bore in the work in said chuck or fixture to grind said bore, the reciprocation of the carriage moving the grinding wheel lengthwise of the bore.

The base of the machine is herein represented as comprising two side walls 10 and two end walls 11 and on the upper edges of the side walls are formed guide grooves or ways 12 to receive V-shaped guides or ribs 13 on the opposite sides of the carriage body 14.

The sides 15 of the carriage body overhang the upper edges of the side walls 10 of the base and the guide ribs 13 are carried upon extensions of the sides 15, each extension projecting inwardly and then upwardly from the sides 15. Guard plates 16 overlie the ribs 13 and ways 12 and extend the full length of said ways, each guard plate having its inner edge, that is the edge next to the inside of the ma-

chine, suitably secured to the upper edge of one of the base walls 10, the plate extending outwardly above the ways 12 and ribs 13 and being curved downwardly at its outer edge into the space provided by the peculiar shape of the side 15 of the carriage body before described. The outer lower edge of the guard plate is in a plane lower than the upper edge of the adjacent way 12. In grinding machines, it is customary to use water or other coolant which becomes mixed with abrasive and foreign substances and this liquid is very apt to be splashed upon the guides of sliding parts and would rapidly wear these parts due to the contained abrasive. The guard plates 16 effectively protect the ways 12 without interfering with the movements of the carriage. A vertical plate 16ª is fixed to and depends from the front end of the carriage to prevent coolant from being splashed upon the driving motor.

In the upper part of the carriage is mounted a rotary spindle 17 having a grinding wheel 18 on its free end, the spindle being mounted in and forming part of a demountable unit which is removable as a whole from the carriage. This unit comprises a sleeve 19 having external conical surfaces 20 to fit into conical bores in the carriage, the sleeve being clamped in these bores by a nut 21 threaded on the small end of the sleeve and bearing against a wall of the carriage. The sleeve contains ball bearings 22 (Fig. 4) in which the spindle 17 rotates. On the end of the spindle opposite the grinding wheel 18 is fixed a pulley 23. In the exemplary form shown in the drawings the external diameter of this pulley 23 is less than the internal diameter of nut 21 so that when the nut is removed, the sleeve 19, spindle 17 and pulley 23 may be withdrawn as a whole from the carriage. If the pulley is of greater diameter than the interior of the nut the pulley will be removed before withdrawing the spindle.

A belt 24 runs over the pulley 23 and over pulley 25 on the armature shaft of a motor 26 which is bolted to the under side of the carriage and occupies the space between the side walls 10 of the machine base, the motor being positioned beneath the horizontal plane of the ways 12. By locating the motor in this manner many beneficial results accrue, among which are increased life of the driving belt by eliminating the travel of the belt along its driving drum as in prior machines; the disposition of the main weight of the carriage beneath the ways 12 thereby reducing vibration; the compactness or saving of space which the arrangement affords; and the safety which results from the elimination of overhead or otherwise exposed belts.

A suitable belt tensioner for the belt 24 is provided comprising, in the present instance, an arm 27 pivoted at 28 and carrying on its free end a pulley 29 which is pressed against the belt by means of a compression spring 30.

The carriage is arranged to be reciprocated by novel hydraulic means which comprises a cylinder 31 that is mounted upon and reciprocates with the carriage. In the present instance, this cylinder is provided with integral flanges 31ª which are bolted to depending portions of the carriage, the motor 26 being in turn bolted to the underside of said flanges 31ª. A piston 32 in said cylinder is stationarily mounted in the end walls 11 of the machine base by means of hollow rods 33 projecting axially from the ends of the piston through the ends of the cylinder. Preferably the rods 33 and the piston 32 are turned from an integral piece of metal. Through these rods the actuating fluid (preferably oil) is introduced into the cylinder on opposite sides of the piston head 32, the rods having transverse bores 34 adjacent to the piston head 32 through which the fluid passes from the rods into the cylinder and vice versa.

The cylinder and the rods are almost wholly enclosed by a stationary housing 35 that is suitably mounted on the machine base, the lower side of the housing being open to accommodate the parts on the lower side of the carriage and permit reciprocation thereof.

The remote ends of the tubes 33 are connected by pipes 36 with a main control valve 37 which governs the admission of the actuating fluid to and its exhaust from pipes 36 and hence the cylinder 31. This control valve 37 is actuated by a lever 38 pivoted at 39 on the machine base, the lever having a projection which is arranged to be alternately engaged by dogs 40 fixed on the carriage to swing the lever.

This results in reversing the valve 37 and alternately admitting pressure fluid into one end or the other of the cylinder and exhausting it from the opposite end. The grinding wheel 18 is thus caused to reciprocate lengthwise in the bore of the piece of work A, Fig. 5. The actuating fluid is delivered to the control valve through a pipe 41 from a pump or other suitable source 42 and the oil escapes from the valve into a receptacle, not shown, from which the pump draws the oil.

It will be noted that the cylinder 31 is also located beneath the horizontal plane of the ways 12 thereby increasing the proportion of the weight of the carriage which is located below said ways with the beneficial results already described.

By use of the hydraulic reciprocating means herein disclosed, I am enabled to reciprocate the carriage at very high speeds without shock at the ends of the stroke and without lost motion or uneven movements of the carriage. The grinding wheel therefore travels back and forth in contact with the work at a constant and even speed which contributes greatly to accuracy as well as in-

creased output. Furthermore, with this mechanism I eliminate reversing gearing or clutches of all kinds which are usually employed in reciprocating mechanisms for this purpose and which have proven to be a constant source of trouble.

I claim as my invention:

1. A machine of the character described having, in combination, a base, a carriage mounted for reciprocation on said base, a rotary spindle in said carriage, said carriage having a depending bracket extending into said base, a piston and cylinder unit having one element supported by said bracket and having the other element stationarily mounted on said base, a motor mounted on the under side of said bracket below said piston and cylinder unit, and means for supplying fluid to said cylinder and exhausting it therefrom to effect reciprocation of the carriage.

2. A grinding machine having, in combination, a base, a carriage mounted for reciprocation on said base, a rotary spindle in said carriage, said carriage having a pair of spaced depending brackets extending into said base, a piston and cylinder unit for driving said carriage mounted between said brackets, means for supplying fluid to said cylinder and exhausting it therefrom, and a motor mounted on the underside of said carriage and bridging said brackets.

3. A grinding machine having, in combination, a base having closed side walls formed with a pair of parallel ways on their upper edges, a carriage mounted for reciprocation on said ways, a pair of spaced brackets depending from said carriage into opposite sides of said base, a piston and cylinder unit for driving said carriage, said unit extending between said brackets, one element of said unit being rigidly secured to said base and the other element of said unit being supported by said brackets, means for supplying and exhausting fluid to and from said unit, and a motor mounted on the underside of said carriage and bridging said brackets, said unit and said motor being located near the horizontal plane of said ways.

In testimony whereof, I have hereunto affixed my signature.

PRENTICE CONRADSON.