Jan. 20, 1959 J. T. HAZAK 2,869,823

AUTOMATIC DROP MECHANISM FOR BORING

Filed March 26, 1957

Fig. 1.

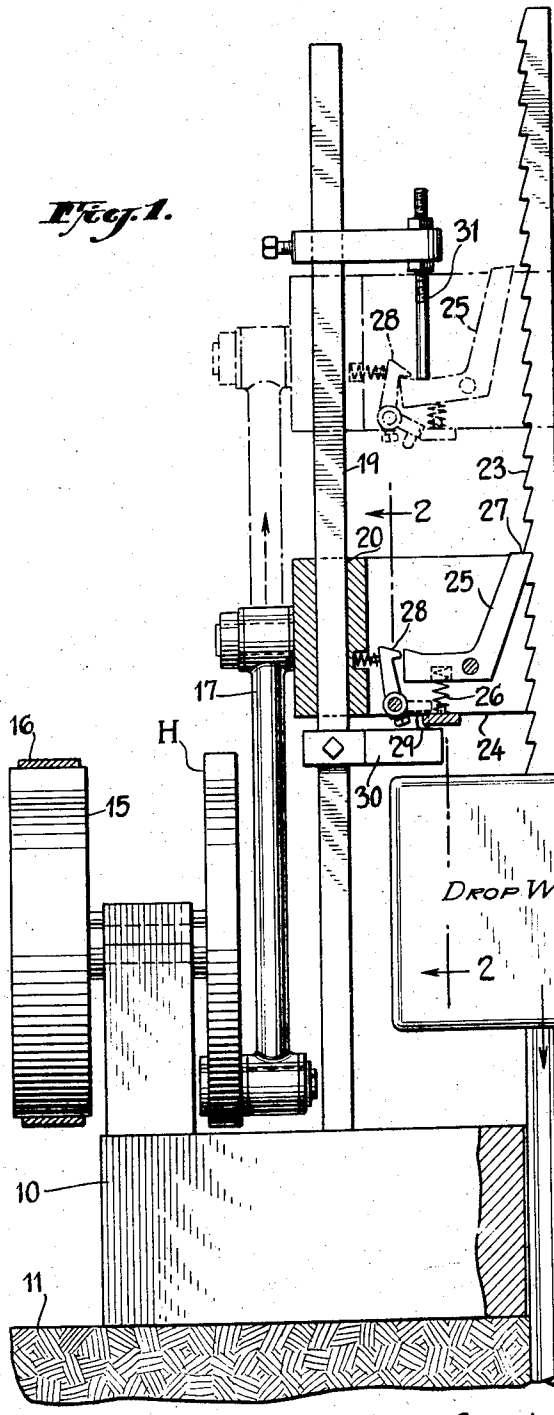
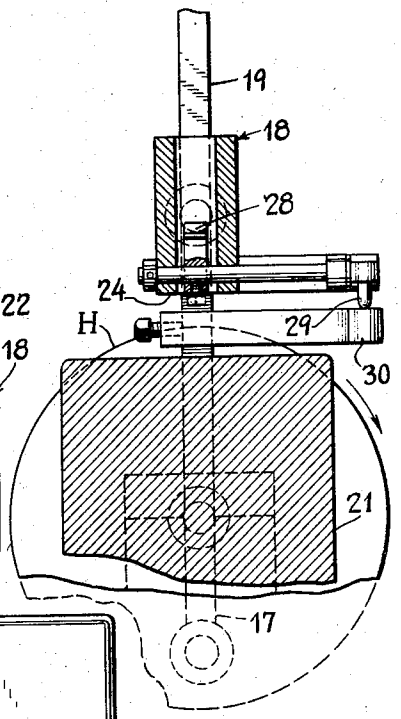


Fig. 2.



INVENTOR.
JOHN T. HAZAK.

BY

Ward, Neal, Haselton, Orme & McElhannon
ATTORNEYS.

United States Patent Office

2,869,823

Patented Jan. 20, 1959

2,869,823

AUTOMATIC DROP MECHANISM FOR BORING

John T. Hazak, New York, N. Y., assignor to Raymond International Inc., New York, N. Y., a corporation of New Jersey

Application March 26, 1957, Serial No. 648,595

3 Claims. (Cl. 255—1)

This invention relates to an improved drop weight mechanism for test borings and more particularly such type apparatus wherein the operation of the drop weight is fully automatic and precision calibrated.

It is common practice in the exploration of a ground site for future construction to drive a boring rod into the soil in order to determine the soil bearing capacity at various penetration depths and also to obtain samples of the types of soil which the contemplated construction will encounter. Heretofore it has been the practice in making such test borings simply to lift a weight by means of a rope attached thereto, with the rope running up through a pulley and then down to a revolving drum. The operation is by hand with the operator tightening the rope around the drum when it is desired to lift the weight. Revolution of the drum will take up on the rope and cause the weight to be lifted to the desired distance above the boring rod which is to be driven into the ground. When the weight is so lifted to the desired distance, the operator simply slips the loops of rope on the revolving barrel, thereby causing the weight to drop and drive the rod a distance into the soil.

When the foot pounds of energy delivered to such a boring rod are precisely known and the distance the rod is driven into the soil by that energy is measured, many formulas exist which enable the engineer to determine from this data the soil bearing capacity at the particular ground site. The energy delivered to the rod is of course a function of the size of the drop weight and the distance through which it is dropped. By predesign the size of the drop weight may be a carefully calibrated known value, and conventional practice calls for this weight to be dropped a distance of thirty inches on each blow so as to insure uniform and known energy impact per blow. However, in the above-described hand operation presently being used, the operator simply judges this thirty inches by eye and when the weight has reached that height, he slips the rope on the revolving drum, thereby permitting the weight to drop onto the top of the rod. Quite obviously, it is inherently impossible for any operator to so slip the rope completely or at precisely the same elevation of the weight relative to the top of the rod on every blow. This is especially true, since with each successive blow the rod will be driven a distance into the ground, thereby changing the elevation level of the top of the rod. Thus the energy delivered to the rod will vary from blow to blow, and the subsequent calculation of the soil bearing capacity by the engineer will be inherently subject to errors which may be large or small, depending upon the degree of accuracy of the operator's visual judgment and manual dexterity.

The present invention overcomes these and other disadvantages of the prior art by providing an apparatus which is automatic in operation and hence not subject to the errors inherent in human judgment and manipulation, and which moreover is provided with carefully calibrated means designed to insure that the drop weight will travel

for each blow a uniform, predetermined distance relative to the top of the boring rod, regardless of how far that rod has been driven into the ground by preceding blows. The invention comprises a power driven, vertically reciprocating crosshead, a lift rod with ratchet rack secured to the drop weight and automatic means for locking said lift-rod relative to said crosshead during the upstroke of the latter, together with automatic means for releasing the lift-rod when the weight secured thereto has been elevated a predetermined distance above the top of the boring rod.

Further objects, features and advantages of the invention hereof will appear from the detailed description given below taken in connection with the accompanying drawings which form a part of this specification and illustrate by way of example preferred embodiments of the invention.

Referring now to the drawings:

Fig. 1 is a front elevational view partly in section of an automatic drop weight mechanism according to the invention, showing in full line the crosshead at the lower end of its stroke and in dotted line the same at the upper end of its stroke; and

Fig. 2 is a fragmentary sectional end elevational view taken on the line 2—2 of Fig. 1.

Referring now in more detail to the drawings, the automatic drop weight mechanism of the invention comprises a supporting base member 10 which is adapted to rest as shown on the ground 11 at the particular location where it is desired to make soil bearing capacity tests. Base member 10 is provided with a vertical bore 12 adapted to slidingly receive a conventional boring rod 13 and serve as a guide therefor. Rotatably mounted on support 10 is a crank wheel H adapted to be driven from sheave 15, which may be connected by belt means 16 to a conventional power source (not shown). The crank wheel H is secured by means of a conventional connecting rod 17 to a reciprocating crosshead 18. An upstanding guide rod 19 is secured to base member 10 and extends through suitable slot means 20 provided in the crosshead. Crosshead 18 is adapted to be reciprocated vertically up and down on this guide rod 19 under the action of the crank H and connecting rod 17. A conventional drop weight 21 of predetermined known weight is secured to a lift rod 22 having a ratchet rack 23 extending along one of its faces. Crosshead 18 is vertically slotted as at 24 to receive the lift rod 22, and there is pivotally mounted within the slot 24 a ratchet pawl 25, which, as shown in full line in Fig. 1, is normally urged by spring means 26 into locking engagement as at 27 with one of the teeth provided on the ratchet rack 23. Also provided within crosshead slot 24 is a pivotally mounted spring pressed pawl lock 28, which as will be described hereinafter is adapted during the downward portion of the crosshead stroke to engage ratchet pawl 25 and maintain the same out of contact with the ratchet rack of lift rod 22.

As shown in full line in Fig. 1, the parts are in the relative positions they would assume at the very beginning of the upstroke of the crosshead 18 or, in other words, at the beginning of the upstroke of lift rod 22 and its attached drop weight 21. At this time, as shown, the drop weight has just delivered an impact blow to the boring rod 13 and rests in contact with the upper end thereof; the lift rod is locked relative to the crosshead by means of the ratchet pawl 25. The pawl lock 28 has been pivoted counterclockwise against the action of its spring out of contact with the ratchet pawl 25 by virtue of its contact at 29 with a pawl lock disengager bar 30 mounted on guide rod 19. With these parts so positioned relative to one another, continued rotation of crank wheel H will cause the connecting rod 17 to drive

the crosshead 18 upwardly along guide rod 19, thereby causing simultaneous and equidistant lifting of the lift-rod 22 and attached drop weight 21. As the crosshead 18 reaches the top of its stroke (as shown in dotted line, Fig. 1), ratchet pawl 25 will come into contact with a pawl disengager bar 31 secured to guide rod 19 and as a result will be pivoted counterclockwise out of engagement with the teeth of the ratchet rack 23, thereby freeing lift-rod 22 and permitting the same to drop freely under the force of gravity and deliver an impact blow to the upper end of the boring rod 13. Simultaneously with the release of the ratchet rack, the ratchet pawl 25 will be engaged by the pawl lock 28, which latter under the urging of its actuating spring will be pivoted clockwise as shown in dotted line so as to engage and lock the ratchet pawl out of contact with the ratchet rack of the lift-rod. Continued rotation of the crank wheel H will cause the crosshead to slide downwardly along guide bar 19, the downstroke of the crosshead being free and independent of the lift-rod 22. When the crosshead has been moved to its lowermost position once again as shown in full line in Fig. 1, contact as at 29 between the pawl lock 28 and the disengager bar 30 will cause the pawl lock to be pivoted counterclockwise out of engagement with the ratchet pawl, thereby freeing the latter so as to permit clockwise rotation thereof under the urging of spring 26 into contact with the nearest tooth of the ratchet rack 23. Thus the cycle is fully automatic, and the parts have now been returned to the relative positions shown in full line in Fig. 1 with the lift-rod and its weight locked relative to the crosshead, and the mechanism is ready for the next upstroke of the drop weight.

It will be understood that the length of stroke of the crosshead will be determined by the dimensions of crank wheel H and connecting rod 17. It will be further understood that on each upstroke of the crosshead, lift-rod 22 and its attached drop weight will be raised a distance above the top of the boring rod equal to that stroke length. Therefore, by properly dimensioning said crank wheel and connecting rod, the mechanism may be predesigned to raise the weight the desired 30-inch distance above the rod on each revolution of the crank, and this regardless of how far the boring rod has been driven into the ground with the preceding blow. Furthermore, by providing the ratchet rack 23 on the lift-rod with precisely machined teeth spaced, for example ¼" or ⅛" apart, such a mechanism will insure very accurate uniform lifting of the drop weight with variations being confined to the distance between adjacent ratchet teeth.

Although a preferred embodiment of the invention is herein disclosed for purposes of explanation, various further modifications thereof, after study of this specification, will be apparent to those skilled in the art to which the invention pertains. Reference should accordingly be had to the appended claims in determining the scope of the invention.

What is claimed and desired to be secured by Letters Patent is:

1. An automatic drop weight mechanism for imparting successive uniform energy impact blows to a boring rod to be driven into the ground for testing purposes which comprises a crosshead assembly, means for mounting said crosshead assembly for vertical reciprocation,

means for successively reciprocating said crosshead through a stroke of predetermined, uniform length, means for maintaining said boring rod in position, a lift-rod having a drop weight secured thereto, said crosshead being adapted to maintain said lift rod in position for dropping said drop weight to the top of said boring rod, automatic means for locking said lift-rod relative to said crosshead at the beginning of and during the upstroke of the latter, the means for locking the lift rod being adapted to subject the lift rod to upward acting forces only, and automatic means for releasing the lift-rod from the crosshead when the latter has reached the upper extremity of its stroke, thereby permitting the weight to drop the predetermined distance to the top of the boring rod, said distance being substantially uniform for each successive blow, regardless of how far the boring rod has been driven into the ground with the preceding blow.

2. An automatic drop weight mechanism for imparting successive impact blows to a boring rod to be driven into the ground for testing purposes which comprises a crosshead, means for mounting said crosshead for reciprocation, crank means for successively reciprocating said crosshead through a stroke of uniform length, means for maintaining said boring rod in position, a lift-rod having a drop weight secured thereto, said crosshead being adapted to maintain said lift rod in position for dropping said drop weight to the top of said boring rod, said lift rod having a ratchet rack, pawl means carried by said crosshead and adapted to engage said ratchet rack at the beginning of the crosshead's upstroke, thereby locking said lift-rod relative to the crosshead, and pawl disengaging means for releasing said pawl means from the ratchet rack when the latter has reached the upper extremity of its stroke, thereby permitting the weight to drop the predetermined distance to the top of the boring rod, said distance being substantially uniform for each successive blow, regardless of how far the boring rod has been driven into the ground with the preceding blow.

3. An automatic drop weight mechanism for imparting successive blows to a boring rod to be driven into the ground for testing purposes which comprises an assembly and means for mounting same for vertical reciprocation, means for successively reciprocating said assembly through a stroke of predetermined, uniform length, means for maintaining said boring rod in position, a drop weight, means for positioning said drop weight so as to deliver blows to said boring rod, means for locking said drop weight relative to said assembly during the upstroke of the latter, the means for locking said drop weight being adapted to subject said drop weight to upward forces only, and means for releasing the dropweight when the latter has reached the end of its upstroke, thereby permitting the weight to drop the predetermined distance to the boring rod, said distance substantially being uniform for each successive blow, regardless of how far the boring rod has been driven into the ground with the preceding blow.

References Cited in the file of this patent

UNITED STATES PATENTS

267,605	Sherman	Nov. 14, 1882
372,143	Harman	Oct. 25, 1887
389,997	Anderson	Sept. 25, 1888