Oct. 16, 1923.

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G. HEY ET AL

MULTIPLE SPINDLE DRILL HEAD

Filed June 9, 1922

3 Sheets-Sheet 1

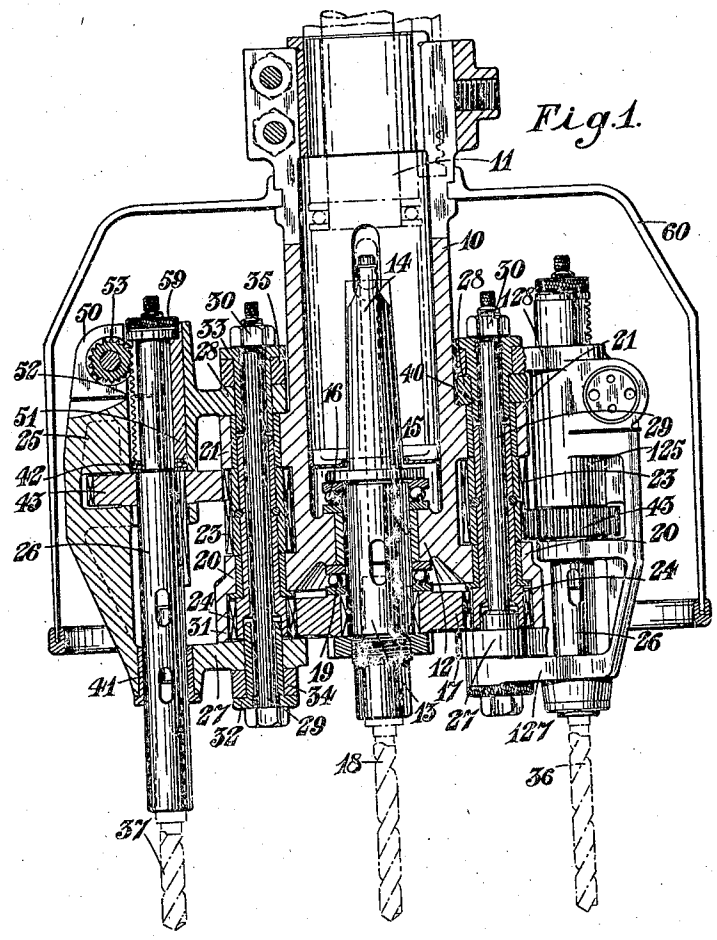


Fig. 1.

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Fig.5.

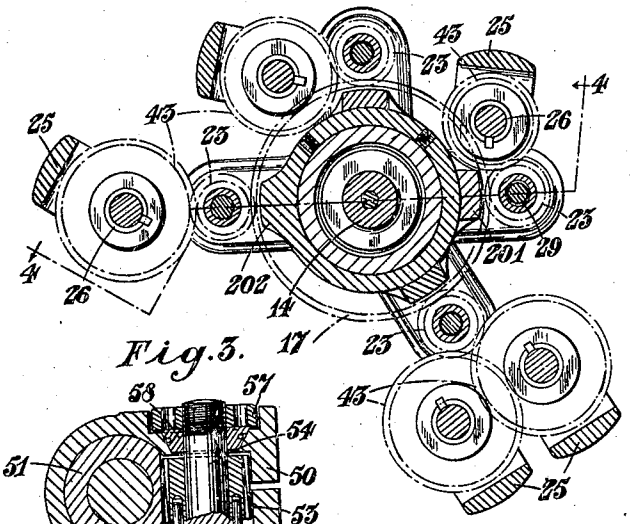
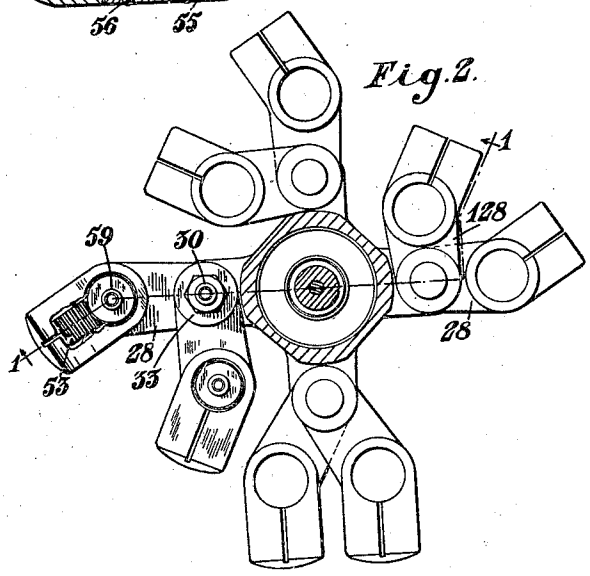


Fig.3.

Fig.2.



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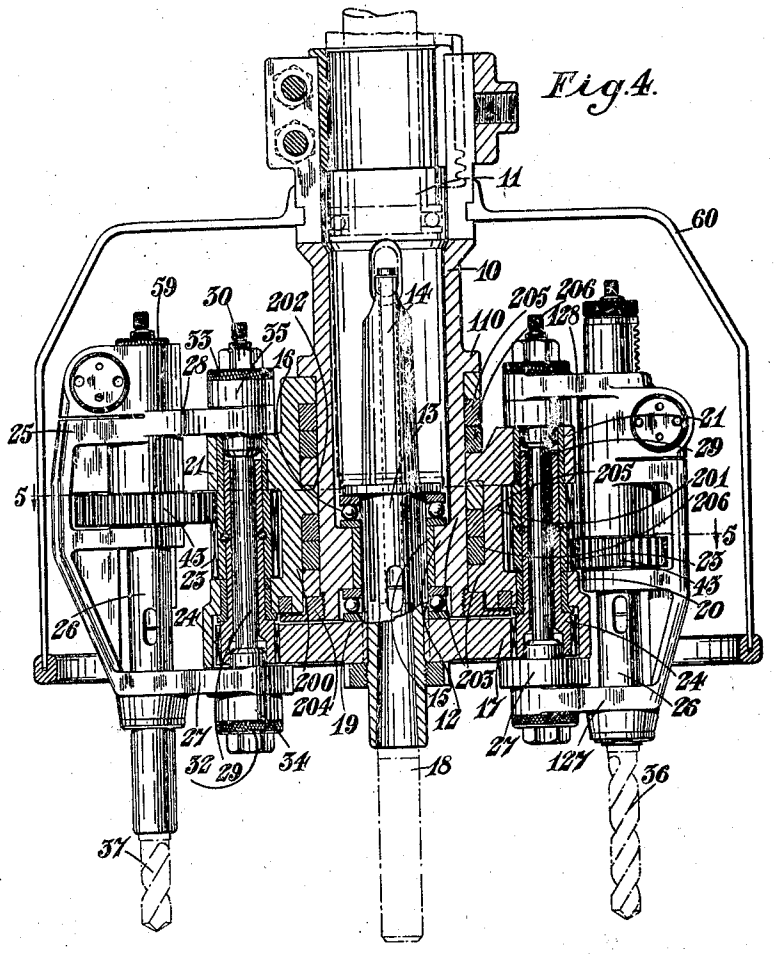
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Fig.4.



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UNITED STATES PATENT OFFICE.

GEORGE HEY, OF ST. MARGARETS-ON-THAMES, AND JAMES ARMSTRONG WILDING, OF LONDON, ENGLAND, ASSIGNORS TO HARPER BEAN LIMITED, OF LONDON, ENGLAND.

MULTIPLE-SPINDLE DRILL HEAD.

Application filed June 9, 1922. Serial No. 567,092.

To all whom it may concern:

Be it known that we, GEORGE HEY, A. M. I. Mech. E., M. I. A. E., and JAMES ARMSTRONG WILDING, subjects of the King of Great Britain and Ireland, residing at, respectively, 50 Orchard Road, St. Margarets-on-Thames, in the county of Middlesex, England, and 132 Long Acre, London, England, have invented a new and useful Improvement in Multiple-Spindle Drill Heads, of which the following is a specification.

This invention relates to multiple spindle drill heads for drilling machines of the type of drill head wherein a supporting member arranged to be attached to a drilling spindle, preferably so as to be adjustable vertically, carries a central driving gear wheel and two or more drill socket members, which latter are provided with pinions arranged to be driven by the central gear wheel by means of vertical intermediate gear wheels which have their axes intermediate of those of the said support and of the said pinions and are also carried by the supporting member.

The invention has for its main object to provide a drill head of the type described so constructed and arranged that its total height is reduced to a minimum, so that drilling machines provided with the improved drill head are stiffer and are capable of taking larger pieces of work than heretofore when they have been provided with multiple spindle drill heads of known construction.

Other features of the invention will be described hereinafter.

In order that the invention may be clearly understood, two embodiments will now be described by way of example with reference to the accompanying drawings. It is to be understood, however, that the invention is not limited to the precise constructional details enumerated.

In said drawings:

Figure 1 is a vertical section taken on the bent line 1—1 in Figure 2 showing one form of multiple spindle drill head according to the invention.

Figure 2 is a diagrammatic horizontal section through the same showing in plan the arrangement of bearing brackets for drill socket members about their central supporting member, and

Figure 3 is an enlarged detail sectional view of a locking device for a drill socket.

Figure 4 is a vertical sectional elevation taken on the bent line 4—4 in Figure 5, showing a modified form of multiple spindle drill head wherein members each carrying an intermediate gear wheel can be detached from and adjusted about the central support, and,

Figure 5 is a diagrammatic horizontal section taken on the line 5—5 in Figure 4 showing in plan the bearing brackets for the drill socket members arranged in various positions.

Like reference numerals designate like parts throughout the several views.

Referring first to Figures 1 to 3, the drill head comprises a tubular supporting member 10 arranged to be attached in the usual manner to the rack sleeve 11 of a drilling spindle, and has at its lower end a head 12. A driving spindle 13 having a tang 14 for insertion into the lower end of the drilling spindle is journalled in the head 12 by means of a vertical plain bearing 15 and a horizontal thrust ball bearing 16. Below the head 12 a central driving gear wheel 17 is fast on the driving spindle 13 the lower end of which is formed as a socket for a central drill 18, a thrust ball bearing 19 being provided between the gear wheel 17 and the head 12.

The supporting member has four lower apertures 20 arranged diagonally opposite one another in pairs on its head and four upper apertures 21 on its side vertically above the former apertures. Each aperture is bushed, and each pair of apertures 20, 21, together with their bushings one above another, constitutes a bearing for an intermediate gear wheel 23, 24. This gear wheel comprises two portions of unequal length, whereof the lower shorter part 24 meshes with the central gear wheel 17, and the upper larger part 23 is situated between two apertures 20, 21. The two parts 23, 24, are of the same diameter, but a compound gear wheel having parts of different diameter may be used if desired.

As shown at the left hand of Figure 1, detachable bearing brackets 25 are provided, each carrying a drill socket member 26, and each having lateral lugs 27, 28, arranged vertically one above the other, by means of

which the brackets can swing each about the vertical axis of an intermediate gear wheel 23, 24. Each of these brackets 25 is secured in position by a bolt 29 that extends freely through an intermediate gear wheel 23, 24, the two apertures 20, 21, and through the two bushed lugs 27, 28 of the bracket, a nut 30 is provided for clamping the bracket in the angular position in azimuth into which it is adjusted. The upper lug 28 is seated on the upper end of the upper aperture 21, and the lower lug 27 bears against the lower end face of a depending flange 31 which is provided on the lower aperture 20 and forms a guard round the lower part 24 of the intermediate gear wheel. The bushes 32, 33 of the lugs 27, 28 do not rest upon these at their ends, but are spaced away therefrom by distance pieces 34, 35 respectively, which are removed when a second bearing bracket is to be secured in position on the same bolt 29, as will now be explained with reference to a second bracket 125, shown at the right hand of Figure 1.

This second bearing bracket 125 is similar to that just described but has its lugs 127, 128 spaced further apart to embrace the lugs 27, 28 of the first bracket 25 and is secured in position by the same bolt 29. For the sake of clearness only the lugs 27, 28 of the bracket 25 are shown at the right hand of Figure 1. The length of the lugs on the second bracket 125 may differ from that of those on the first, in order that a drill 36 carried by it may be set further away from the centre of the drill head than can a drill 37 carried by the first bracket 25, whereby a greater degree of adjustability is secured as to points at which holes may be drilled. The two lower lugs 27, 127 are threaded on the head end of the bolt 29 below the lower aperture 20, and the two upper lugs 28, 128 are journaled on the nut end of the bolt 29 above the upper eye 21. As shown at the nut end of the right hand bolt 29 each of these pairs of lugs is secured in position by a three-diameter split shouldered sleeve 40, one under the head and the other under the nut of the bolt. These sleeves bear with shoulders on the outer faces of the two outside lugs, and with other shoulders on the upper lower faces of the two inside lugs, so that when the nut of the bolt is tightened the two brackets are clamped firmly one on the other and on the support. If the second bracket 125 is not required at any time it can be removed by removing the bolt 29 and its sleeves 40, whereupon the bolt with the same sleeves can be used for securing the one bracket in the required position on the support, or the alternative arrangement with distance-pieces 34, 35 described above may be employed.

Each drill socket member 26 is journaled in its bracket by a plain vertical bearing 41 and a horizontal thrust ball bearing 42, and carries a pinion 43 keyed to it between these bearings. This pinion is of such a size that when the bracket carrying it is mounted as described above, it meshes with the upper part 23 of its allotted intermediate gear wheel. The drill socket member 26 thus extends upwards alongside the drilling spindle, and consequently the total height of the drill head is reduced as compared with known constructions in which the drill socket members have been driven by the lower parts of intermediate gear wheels, or by the part of an intermediate gear wheel situated below the level of a central driving gear wheel, such as the wheel 17. Consequently larger work can be accommodated in the drilling machine. When two bearing brackets 25, 125 are mounted on the same pair of apertures to swing about the axis of an intermediate gear wheel common to the two as just described above, then the pinions 43 in the two brackets will be at different levels in order to enable the brackets to be swung close together without the pinions fouling one another. As shown in Figure 1 the pinion 43 at the right hand side of the figure is at a lower level than the pinion 43 at the left hand side.

Each drill socket member 26 is adjustable endwise in its bearing bracket 25 or 125. For this purpose the upper end of the bearing bracket is split and constitutes a split sleeve 50 (Figure 3) in which is provided a bushing 51 having at one side rack teeth 52 and the said thrust bearing 42 at its lower end. The pinion 43 is splined on the socket member in such a manner that the latter can move endwise through it when it is shifted by the toothed bushing 51. This meshes with an adjusting pinion 53 that is carried by a bolt 54 extending through the two ears of the split sleeve. The head 55 of this bolt is countersunk in one ear and has pins 56 connecting it for rotation with the adjusting pinion 53. A nut 57 is let into the other ear and bears against a washer or collar 58 that is coned or tapered on the outside and is preferably split. This washer bears against a correspondingly conical seat in the ear containing the nut. When the nut 57 is tightened, the washer 58 is forced into the split sleeve and grips it as well as the bolt, thereby fixing the pinion 53 and bolt 54 as a rigid member to the bracket 25 and preventing the toothed bushing 51 from shifting endwise. To adjust the socket member 26 vertically it is only necessary to slacken the nut 57, whereupon the bolt 54 can be turned by a key having pins for insertion into holes provided for them in the end face of the head 55 of the bolt. A lock nut 59 is provided for detachably securing the toothed bushing 51 on the socket member 26. A guard 60 suspended by its

upper edge from the supporting member 10 may be provided surrounding the entire drill head.

Owing to the drill socket members being mounted in the manner described above a very rigid construction of drill head is provided and it is found in practice that a large number of large diameter drills can be used simultaneously without undue bending stresses being set up.

Referring now to Figures 4 to 5 this construction differs principally from that described above with reference to Figures 1 to 3 in the apertures, in which the bolts constituting the axles of the intermediate gear wheels are mounted, being not integral with the supporting member 10, but provided on members mounted so as to be readily detachable from and angularly adjustable on the member 10. As shown, two sleeves 200, 201 have inwardly directed flanges 202, 203 respectively, fitting the member 10 with the upper flange 202 bearing against a flange 110 on the member 10. Two other sleeves whereof the flanges 205, 206, only are shown are simularly threaded on the member 10. A nut 204 screwed on the lower end of the member 10 above the level of the gear wheel 17 securely holds all these sleeves rigidly in position. Each of these sleeves has radial outwardly directed eyes 20, 21 arranged one above another in pairs for carrying bolts 29. This arrangement enables the intermediate gear wheel 23, 24 carried by any one of the sleeves to be readily adjusted in azimuth in relation to that carried by the other sleeves, and also enables all the intermediate gear wheels and the drill socket members allotted thereto to be readily removed from the drill head and be replaced by others of different size, thereby converting the drill head shown in Figures 1 to 3 into a universal drill head.

Obviously, instead of four pairs of apertures for carrying bearing brackets being provided as described above with reference to Figures 1 to 3, two, three or more pairs may be provided, according to the number of drills required to be used at any time, whilst each sleeve, such as 200, 201 shown in Figure 4 may have one or more pairs thereof.

We claim:—

1. A multiple spindle drill head of the type described, comprising a drill head, a central driving spindle rotatable in said head, a series of bearing bracket members around said central spindle, an intermediate spindle associated with each of said bracket members and forming the hinge pin about which said bearing brackets may be adjusted with relation to said central spindle, a gear wheel towards the lower end of said central spindle, gear wheels on said intermediate spindles gearing towards their lower ends with the gear wheel on the central spindle, drill socket members rotatable in said bearing brackets, and gear wheels on said socket members gearing with the gear wheels on the intermediate spindle associated therewith towards the upper end thereof, for the purposes set forth.

2. A multiple spindle drill head of the type described, comprising a tubular supporting member, a driving spindle rotatably mounted in said supporting member, a gear wheel on said spindle, a plurality of pairs of apertures disposed laterally around said supporting member, a plurality of bearing bracket members provided each with a pair of lateral lugs, a bolt passing through each pair of apertures on the supporting member and the lugs on one of the bearing brackets and constituting an axle about which the bearing bracket is adjusted, a gear wheel on each of said axles, meshing at its lower end with the gear wheel on the driving spindle, drill socket members mounted in each of said brackets and gear wheels keyed to said socket members and gearing with the upper portion of the gear wheel on the axle associated therewith, for the purposes set forth.

3. A multiple spindle drill head of the type described, comprising a tubular supporting member, a series of sleeve like members, flanges on said members adapted to be journaled onto said supporting member, means for securing said sleeve like members in position, apertures on each of said sleeve like members, a bearing bracket associated with each of said sleeve members, lugs on each of said bearing brackets, an axle passing through the apertures of each of said sleeve members and the lugs on the bracket associated therewith, drill socket members in each of said brackets, gear wheels on said socket members, a gear wheel on each of said axles meshing towards its upper end with the gear wheel on the drill socket member associated therewith, a central driving spindle rotatable in said supporting member, and a gear wheel on said driving spindle gearing with each of said gear wheels on said axles, for the purposes set forth.

4. A multiple spindle drill head of the type described, comprising a central driving spindle mounted rotatably in a tubular supporting member, a gear wheel on said spindle, a series of drilling elements arranged in pairs round said central driving spindle, each pair of drilling elements comprising two independent bearing brackets adjustable in azimuth with relation to the central driving spindle, each of said brackets having spaced super-imposed lugs thereon co-operating with spaced super-imposed apertures on the supporting member to receive on intermediate axle, a gear wheel on

said axle, in driving engagement at its lower end with the gear wheel on the central spindle, a drill socket member mounted rotatably in each of said brackets and a gear wheel on each of said socket members arranged at different relative heights and each meshing with the gear wheel on the intermediate axle in the neighbourhood of its upper end, for the purposes set forth.

5. A multiple spindle drill head of the type described, comprising a central driving spindle mounted rotatably in a tubular supporting member, a gear wheel on said spindle, a series of drilling elements arranged in pairs around said central driving spindle, each pair of drilling elements comprising two independent bearing brackets adjustable in azimuth with relation to the central driving spindle, each of said brackets having spaced super-imposed lugs thereon co-operating with spaced super-imposed eyes on the supporting member to receive an intermediate axle, a gear wheel on said axle, in driving engagement at its lower end with the gear wheel on the central spindle, a drill socket member mounted rotatably in each of said brackets, gear wheels on each of said socket members arranged at different relative heights with respect to the gear wheel on the central spindle and each meshing with the gear wheel on the intermediate axle associated therewith towards its upper end, and means for connecting each socket member to the gear wheel associated therewith to enable the same to slide therethrough without alteration of the plane of rotation of said gear wheel, for the purposes set forth.

6. A multiple spindle drill head of the type described, comprising a central driving spindle mounted rotatably in a tubular supporting member, a gear wheel on said spindle, a series of drilling elements arranged in pairs around said central driving spindle, each pair of drilling elements comprising two independent bearing brackets adjustable in azimuth with relation to the central driving spindle, each of said brackets having spaced super-imposed lugs thereon co-operating with spaced super-imposed apertures on the supporting member to receive an intermediate axle, a gear wheel on said axle in driving engagement at its lower end with the gear wheel on the central spindle, a drill socket member mounted rotatably in each of said brackets, a gear wheel on each of said socket members arranged to rotate in different parallel planes and each meshing with the gear wheel on the intermediate axle associated therewith towards its upper end, means for axially adjusting each of said drill socket members with relation to the gear wheel associated therewith, and means for locking said adjusting means.

7. A multiple spindle drill head of the type described, comprising a central driving spindle mounted rotatably in a tubular supporting member, a gear wheel on said spindle, a series of drilling elements arranged in pairs around said central driving spindle, each pair of drilling elements comprising two independent bearing brackets adjustable in azimuth with relation to the central driving spindle, each of said brackets having spaced super-imposed lugs thereon co-operating with spaced super-imposed apertures on the supporting member to receive an intermediate axle, a gear wheel on said axle in driving engagement at its lower end with the gear wheel on the central spindle, a drill socket member mounted rotatably in each of said brackets, a bearing bushing for each of said drill socket members, a gear wheel on each of said socket members arranged to rotate in a different parallel plane, and each meshing with the gear wheel on the intermediate axle associated therewith towards its upper end, a rack on each of said bushings, a pinion meshing with said rack and adapted to adjust the drill socket member and bushing axially within said bearing bracket, and means for locking said pinion and bush in any adjusted axial position, for the purposes set forth.

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