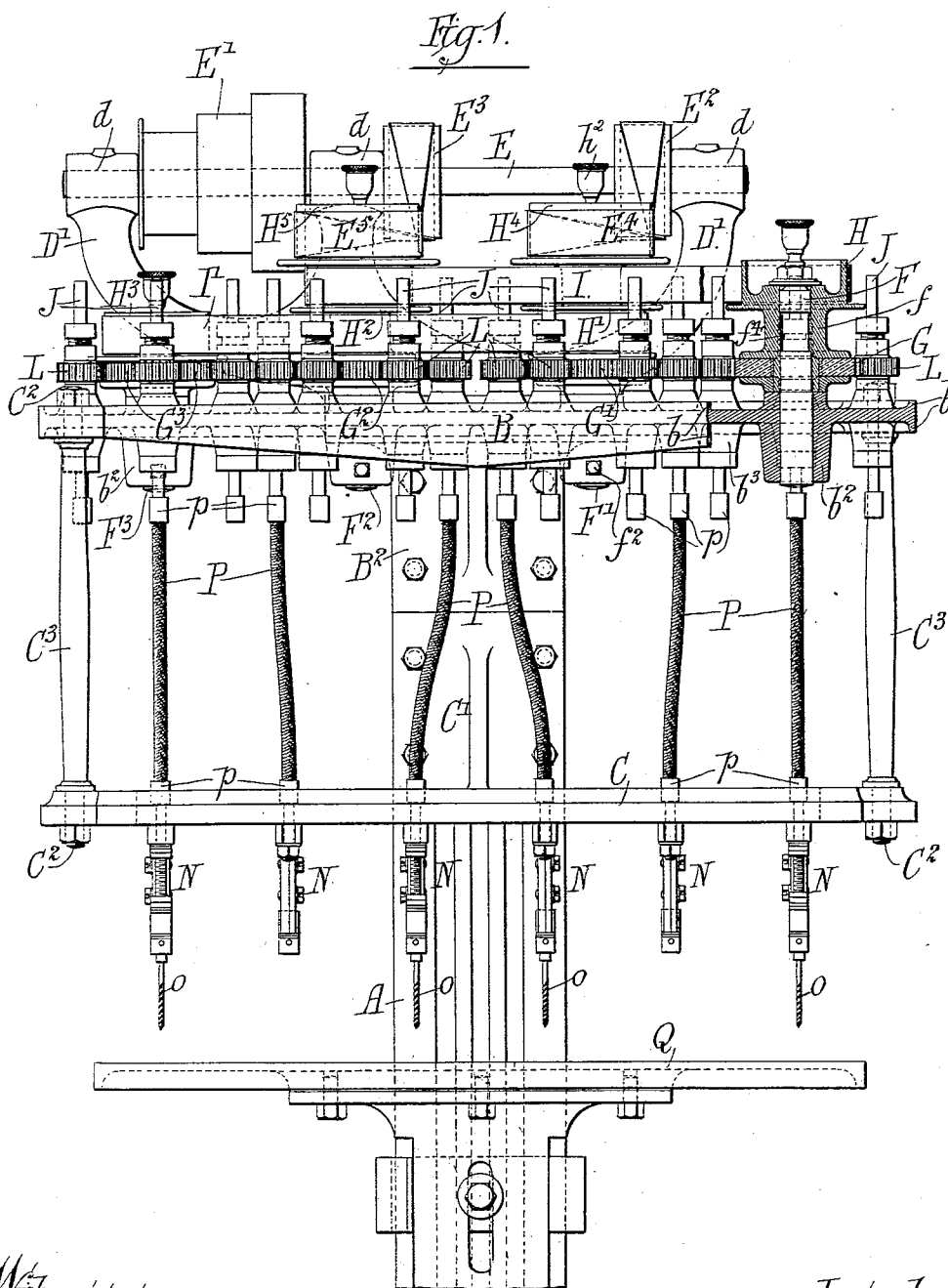


4 Sheets—Sheet 1.

No. 560,171.

Patented May 12, 1896.



Witnesses:-
Louis M. F. Whitehead.
E. W. Higgins Jr

Inventor:-
August John Dehring
By:- Dayton. Pool & Brown.
His Attorney's:-

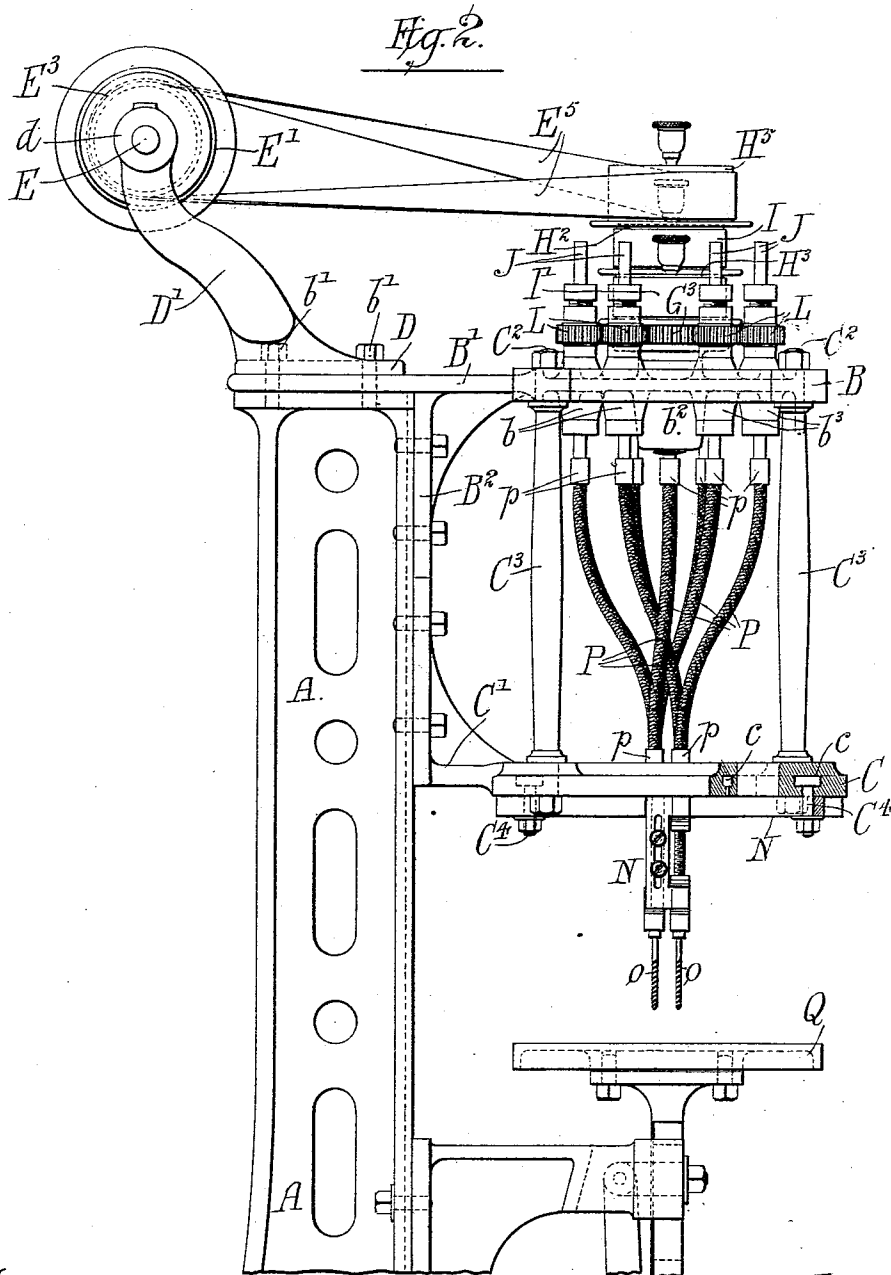
(No Model.)

4 Sheets—Sheet 2.

A. J. OEHRING.
MULTIPLE DRILL.

No. 560,171.

Patented May 12, 1896.



Witnesses:

Louis H. F. Whitehead.

G. W. Higgins Jr.

Inventor:

August J. Oehring

By: Dayton, Poole & Brown.

His Attorneys.

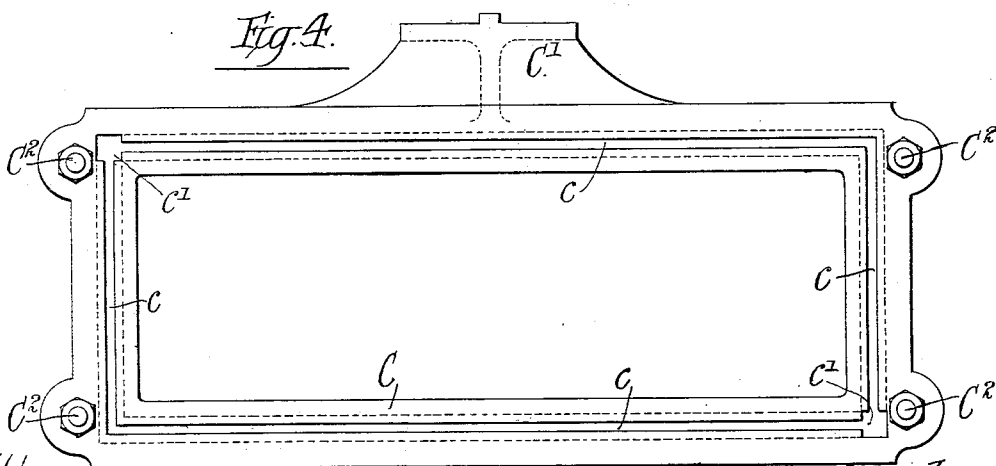
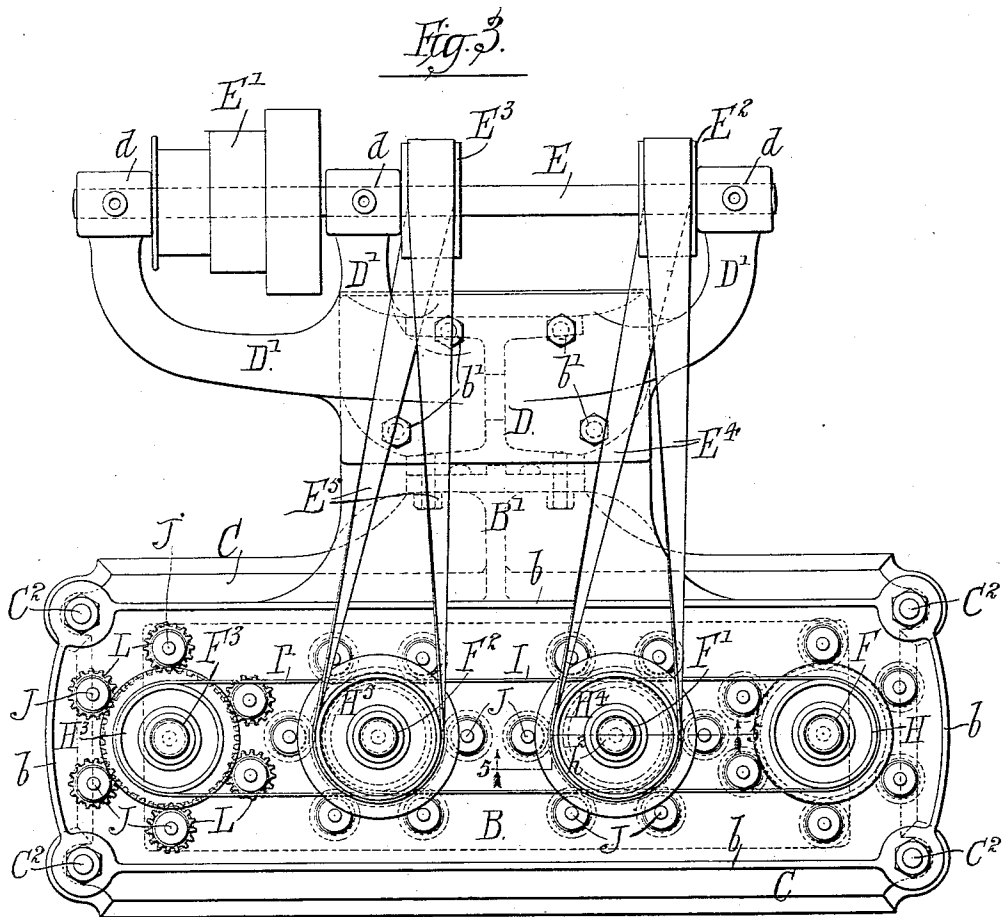
(No Model.)

4 Sheets—Sheet 3.

A. J. OEHRING.
MULTIPLE DRILL.

No. 560,171.

Patented May 12, 1896.



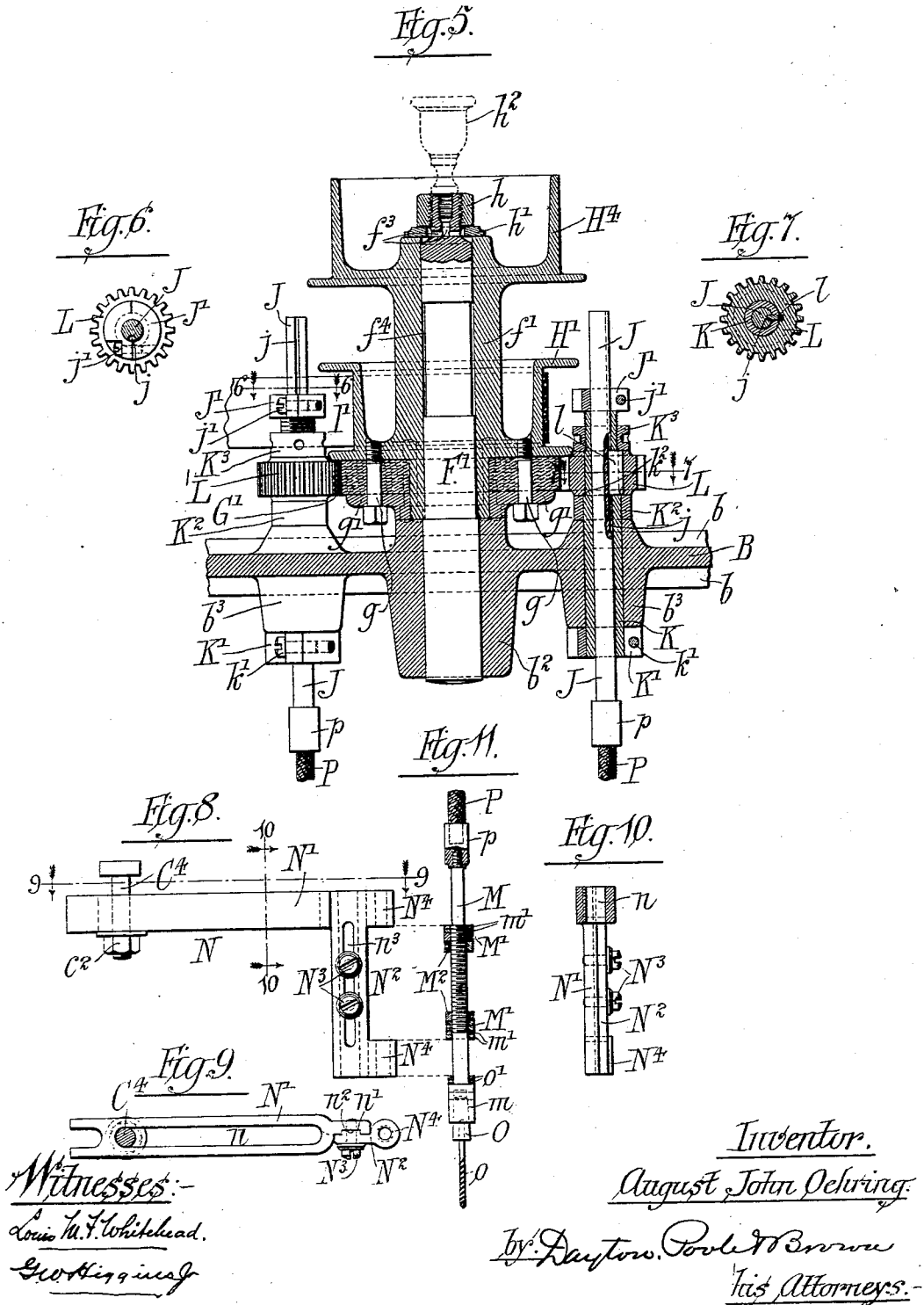
Witnesses:
Louis H. F. Whitehead.
Geo. Higgins Jr.

Inventor:
August John Oehring
By: Dayton, Poole & Brown,
his Attorneys.

A. J. OEHRING.
MULTIPLE DRILL.

No. 560,171.

Patented May 12, 1896.



UNITED STATES PATENT OFFICE.

AUGUST J. OEHRING, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-THIRD TO
THE PRATT & CADY COMPANY, OF HARTFORD, CONNECTICUT.

MULTIPLE DRILL.

SPECIFICATION forming part of Letters Patent No. 560,171, dated May 12, 1896.

Application filed March 3, 1891. Serial No. 383,615. (No model.)

To all whom it may concern:

Be it known that I, AUGUST J. OEHRING, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful
5 Improvements in Multiple Drills; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon,
10 which form a part of this specification.

This invention relates to multiple drills, and has for its object to provide a machine by means of which a plurality of holes arranged at regular or irregular intervals and extend-
15 ing to various depths may be simultaneously drilled; and to this end it consists in certain features which will be hereinafter fully described, and then pointed out in the claims.

In the drawings, Figure 1 is a front elevation, partly in section, of a machine embodying my invention in one form. Fig. 2 is a side elevation of the same, partly in section. Fig. 3 is a plan view. Fig. 4 is a bottom plan view of the lower frame, in which the lower
25 drill-spindles are mounted, the same being shown detached from the machine. Fig. 5 is a detail sectional view, on an enlarged scale, taken on the line 5 5 of Fig. 3. Fig. 6 is a detail plan section of the top of one of the upper
30 drill-spindles and its associated parts, taken on the line 6 6 of Fig. 5. Fig. 7 is a detail plan section taken on the line 7 7 of Fig. 5. Fig. 8 is a side elevation of one of the arms which hold the lower drill-spindles, the same
35 being shown detached from the machine. Fig. 9 is a plan section of the same, taken on the line 9 9 of Fig. 8. Fig. 10 is a sectional view of the same, taken on the line 10 10 of Fig. 8. Fig. 11 is an elevation, partly in section,
40 of one of the lower drill-spindles detached.

A indicates the column or upright main frame of the machine, which carries and supports the remaining portions thereof, said column having mounted on it the upper and
45 lower frames B and C, which carry, respectively, the upper and lower groups of drill-spindles. The upper frame B has a rear extension B' and downward extension B², by means of which it may be bolted to the column
50 A. The frame C has a rearward and upward extension C', which abuts against the exten-

sion B², and by means of which the frame C also may be bolted to the column A. The upper frame B is shown in the form of a plate provided with a suitable marginal strengthening-rib *b*, and having suitable apertures and
55 bearings to receive the various shafts and spindles which are mounted therein. The lower frame C will preferably take the form of an open frame, and has in its under face a
60 T-shaped groove *c*, extending entirely around the same, enlargements *c'* of said groove being formed at the corners of the frame, for the purpose hereinafter set forth. The frames B
65 and C may be connected at their four corners by tie-bolts C², which are inclosed in hollow columns C³, interposed between the frames, or in any other suitable manner; but obviously they may be cast in one integral piece, this latter construction being preferred in
70 some of the styles of machines in which I embody the invention.

D represents a plate secured on the top of the column A, preferably by the same bolts
75 *b'* which secure the extension B'. From this plate rise diverging arms D', provided at their extremities with bearings *d*, in which is mounted a counter-shaft E, provided with a stepped pulley E', by means of which it may
80 be driven from any suitable source, and having also secured on it pulleys E² and E³. The upper frame B is provided with a plurality of fixed shafts F F' F² F³. (Shown in the present
85 instance as four in number, although it is obvious that the number may be varied, as desired.) The shaft F is provided with a sleeve *f*, mounted to rotate thereon and provided at its lower end with a gear G, and at its upper
90 end with a pulley H, as shown in Fig. 1. The shaft F' has mounted on it a sleeve *f'*, provided at its lower end with a gear G' and having above said gear a pulley H'. The shaft F² is similarly provided with a gear G²
95 and pulley H² and the shaft F³ with a gear G³ and pulley H³. It will be observed that the pulleys H and H² are arranged above the pulleys H' and H³, and these respective pairs of pulleys are connected with each other by
100 belts I and I', the former passing over the pulleys H and H² and the latter over the pulleys H' and H³. The shafts F' and F², or, more strictly speaking, the sleeves thereon, are pro-

vided at their upper ends with pulleys H⁴ and H⁵, by means of which they are driven through the medium of belts E⁴ and E⁵ from the pulleys E² and E³.

5 The several fixed shafts are similar in their mounting and general structure, and for the purpose of illustration I have shown in detail in Fig. 5 the shaft F'. The frame B is provided with a boss or bearing b², extending
10 both above and below the web thereof, and in which the shaft F' is secured by means of a bolt f². The sleeve f' on said shaft has formed in one piece with it the pulleys H' and H⁴, a sufficient space being left between
15 said pulleys for the passage of the belt I. The gear G' is secured to the lower end of the sleeve f' by means of bolts g passing through a combined washer and clamping-disk g', interposed between said gear and the top of the
20 boss or bearing b². The upper end of the shaft F' is reduced and threaded externally to receive a nut h, which in conjunction with an interposed washer h' holds the sleeve in position on the shaft. An oil-cup h², screwing
25 into the end of the shaft, supplies lubricating material between the shaft and sleeve, the shaft being provided with suitable oil-passages f³ and being reduced circumferentially to form an oil-chamber f⁴ between the
30 shaft and sleeve. Around each gear G, G', G², and G³ are located a group of spindles J, which are the upper drill-spindles. In the present instance I have shown six spindles associated with each central gear; but it is
35 obvious that the number and arrangement may be varied as desired.

I will now proceed to describe the construction and mounting of one of the spindles J, referring more particularly to Figs. 5, 6, and
40 7, it being understood that the same description is equally applicable to the remaining upper spindles. Each spindle J is provided with a longitudinal groove j and with a split collar J', which is adjustable on said spindle
45 and which may be clamped thereon after adjustment by means of a screw j'.

K represents a sleeve in which the spindle J fits and may be moved longitudinally, the two rotating together. This sleeve is mounted
50 in a suitable bearing b³ on the frame B and is provided at its lower end with an adjustable split collar K', clamped on it by a screw k' to prevent upward movement of the sleeve. Above the bearing b³ there is placed
55 on the spindle a loose collar K², and above this collar the sleeve K is reduced, forming a shoulder k².

K³ is a nut mounted on the threaded upper end of the sleeve K and serving, in conjunction with the shoulder k², to clamp upon
60 the sleeve K a pinion L, which meshes with the central gear G'. The gear L is longitudinally grooved internally, and a corresponding slot is formed through the sleeve K, and
65 a spline or key l extends through the said groove and slot and into the groove j in the spindle J, thus so uniting the pinion, sleeve,

and spindle as to cause them to rotate together, while at the same time it allows the spindle to be moved vertically therein, as
70 desired, its downward motion being limited by the collar J'.

The lower drill-spindles M, which carry the drills, are all similarly constructed and mounted, and the following description of one of
75 them applies equally well to all. Each spindle is connected with the frame C by means of a two-part supporting-bracket N, one member N' of which is adjustably connected with the frame C. This connection is effected by
80 means of a bolt C⁴, which passes through a slot n in the horizontal portion of the member N', the rectangular head of which bolt fits in the groove c of the frame C, while its lower end receives a washer and a clamping-
85 nut c², by which the said member N' may be clamped against the under face of the frame C, so as to bring the spindle M into any position desired. The enlargements c' of the
90 groove c permit the introduction of the heads of the bolts C⁴ into said groove and also their removal therefrom in an obvious manner. It will be observed that not only may the bolt C⁴ be adjusted to any desired point in the
95 grooved frame, but the member N' may be adjusted radially around said bolt as a center and also adjusted in or out relatively thereto by reason of the slot n, and its free end may therefore be laterally brought to
100 any desired position in a plane parallel with the frame C. The member N' has a vertical portion at its free end, grooved as shown at n', and the other member, N², of the bracket-frame N is adjustably mounted on this vertical
105 portion and is provided with a rib or tongue n² to fit the groove n'. Clamping-bolts N³, passing through a slot n³ in the member N² and screwing into the member N', serve to clamp the two members of the
110 bracket N together after adjustment. The member N² is provided with bearings N⁴ to receive the spindle M, and by means of the vertical adjustment of the member N², which carries the spindle, this latter may be vertically
115 adjusted as desired. The spindle M is provided at its lower end with a socket m to receive a drill-chuck O and drill o. Steel washers o' may also be interposed between
120 said socket and the lower bearing N⁴ to prevent excessive friction. The portion of the spindle M between the bearings N⁴ is shown as being threaded to receive adjusting and locking nuts M' M², arranged in pairs at the
125 top and bottom of the said threaded portion, said nuts, in conjunction with pairs of steel washers m', interposed between them and the bearings N⁴, serving to hold the drill-spindle M in position without excessive friction and at the same time to give it the proper "end
130 shake."

While I have shown two sets of adjusting and locking nuts M' M², I do not desire to be limited thereto, since it will be manifest to any skilled machine-builder that in many

forms of a machine embodying my invention they will not be required and that a single nut may answer the purpose. In such event the single nut would most probably be placed on the spindle M at a point above the uppermost bearing N¹, which when set would draw the steel washer o or the shoulder on the socket m of the spindle firmly against the under side of the lowermost bearing N¹, as will be readily understood without further elaboration.

The spindles M are connected with the corresponding spindles J by means of flexible shafts P, of any well-known type; but in most cases I prefer to use the style of flexible connection shown in United States Letters Patent No. 478,811, issued to me on the 12th day of July, 1892. These flexible shafts permit the desired adjustment of the lower spindles M, being of sufficient length for this purpose and serving to transmit the rotary motion of the upper spindles to the lower ones in whatever position these latter may be arranged. Suitable sockets p are mounted on the ends of the spindles J and M to receive the ends of the flexible shafts and complete the connection.

Q represents the work-holding table, which in the present instance is of that type which both holds the work and feeds it to the drills, and which may be of any suitable construction and provided with any suitable mechanism for these purposes. These features, however, form no part of my present invention and therefore need no description here.

The machine thus organized operates in the following manner: A number of drills equal to the number of holes to be simultaneously drilled are employed, and the lower spindles are independently adjusted to the proper position horizontally by means of the connection described between the two-part bracket N and the frame C, so as to form the holes at the desired intervals. Each lower spindle is also independently adjusted as to its vertical position by means of the relative adjustment of the two parts of the bracket N to regulate the depth of the several holes to be drilled. The free vertical movement of the upper spindles permits the lower spindles to be freely moved and adjusted horizontally and vertically without affecting the driving mechanism. Each change in the position of any one of the lower spindles varies its distance in a direct line from its driving-spindle, and the freedom of vertical movement of said driving-spindle is provided for the purpose of causing it to adjust its position to these varying distances and thus prevent any binding or straining of the parts. The adjustable collars on the upper spindles serve, by limiting the downward movement of these spindles, to prevent their disengagement from their driving mechanism and to determine the amount of slack of the flexible shafts. The work is then secured on the work-holding table and fed to the drills, and these latter being actu-

ated through the medium of the mechanism described the holes will be simultaneously drilled in the work at the desired intervals and to the desired depth in one continuous operation and without rehandling the work. It is obvious that when a large number of similar articles are to be operated upon, the machine having been once adjusted, all the articles may be operated on successively with great rapidity and the holes drilled at exactly the same intervals and to exactly the same depths in each article. The range of adjustment of the spindles is only limited by the size of the machine, and the mechanism for imparting motion to the adjustable spindles is of great simplicity and efficiency.

Although I have shown a preferred form of mechanism which I have devised for imparting motion to the upper spindles, I do not wish to be understood as limiting myself to the precise mechanism hereinbefore described, and shown in the drawings, as it is obvious that other means may be employed for this purpose without departing from the principle of my invention. The same is true of the adjustable supporting of the lower spindles, as other means may obviously be employed for firmly holding said spindles while at work and at the same time permitting their adjustment. Moreover, although I have shown my invention as embodied in the present instance in a drill of that type in which the work is fed to the drills, it is not limited to such an application, but may be used in that type of machines in which the drills are fed to the work.

While, therefore, many modifications will suggest themselves to the skilled mechanic in embodying the principles of my invention in a machine designed for some special work, I distinctly desire to be understood that all such modifications are embraced within the scope of my invention as herein claimed. Nevertheless the form in which the invention is herein shown, both in its general aspect as well as in its various details, is recommended after a long experience with it in various uses as a commercial and practical embodiment of the invention.

I have illustrated herein a desirable form of driving mechanism for the upper spindles, as stated in claims 8 and 9 herein, but I desire to call attention to the mechanism shown in United States Letters Patent No. 544,068, for driving mechanism for multiple drills, issued to me August 6, 1895, as illustrating one of several forms of driving mechanism that may be used in carrying out the invention herein described and claimed.

What I claim is—

1. In a multiple drill, the combination, with the drill-carrying spindles, and flexible shafts for driving the same, of a frame arranged in a plane at right angles to the axes of the spindles, and bracket-supports for the said spindles, connected with said frame and independently adjustable in all directions in

the plane of the same, substantially as described.

2. In a multiple drill, the combination, with the drill-carrying spindles, and flexible shafts for driving the same, of an open frame, and bracket-supports for the drill-carrying spindles adjustably connected with said frame, substantially as described.

3. In a multiple drill, the combination with the drill-carrying spindles and their flexible driving-shafts, of a frame and a two-part bracket-support for each spindle, one member of which is horizontally adjustable on the frame, and the other member of which is vertically adjustable on said first-mentioned member and carries the spindle, substantially as set forth.

4. In a multiple drill, the combination, with the frame C, having groove c, and bolts C¹, of the two-part bracket-supports N, each composed of a member N' having a horizontal portion slotted to receive a bolt C¹, and a vertical portion grooved at n', and a member N², having a tongue n² slot n³ and spindle-bearings N⁴, and clamping-bolts N³, substantially as set forth.

5. The combination, with a support having bearings N⁴, of a drill-spindle mounted in said bearings and having an intermediately-threaded body portion, nuts on said threaded portion, and washers interposed between the nuts and bearings, substantially as described.

6. The combination, with the support N, having bearings N⁴, of the spindle M mounted in the bearings N⁴, having an intermediately-threaded body portion and provided with socket m, washers o' interposed between said socket and the lower bearing, washers m' on said intermediate portion and nuts M' M² for holding said washers in position, substantially as described.

7. In a multiple drill, the combination with driving and drill-carrying spindles and flexible shafts connecting the driving-spindles with the drill-carrying spindles, in pairs, of a frame-upright, a frame carrying the driving-spindles and a frame carrying the drill-carrying spindles, both said frames projecting from said upright, and columns and tie-bolts connecting the projecting portions of said spindle-carrying frames.

8. In a multiple drill, the combination with the drill-carrying spindles and their flexible shafts, of an upper frame provided with a plurality of central shafts having gears and driving-pulleys, and the upper drill-spindles arranged in groups around each central shaft, each spindle being provided with a pinion to

mesh with the gear thereon and connected with one of the flexible shafts, substantially as described.

9. In a multiple drill, the combination, with the lower drill-carrying spindles and their flexible shafts, of the central shafts F, F', F² and F³, having respectively gears G, G', G² and G³ and pulleys H, H', H² and H³, the upper spindles J connected with the flexible shafts and having pinions L to mesh with said gears, the belts I and I' connecting the pulleys H, H² and H' H³ respectively, the pulleys H⁴ and H⁵ on the shafts F' and F², the counter-shaft E having pulleys E' E² and the belts E⁴ and E⁵ connecting said last-mentioned pairs of pulleys, substantially as described.

10. In a multiple drill, the combination of a plurality of driving-spindles which are severally movable longitudinally a plurality of drill-carrying spindles which are independently adjustable laterally, and flexible shafts each connecting a driving with a drill-carrying spindle, substantially as described.

11. In a multiple drill, the combination of a plurality of longitudinally-movable driving-spindles, a plurality of drill-carrying spindles which are adjustable in all directions and flexible shafts connecting the driving and drill-carrying spindles in pairs, substantially as described.

12. In a multiple drill, the combination of a plurality of stationary drill-driving pinions, rotatively supported in a suitable frame and provided with axial openings, driving-spindles longitudinally adjustable in said openings, laterally and vertically adjustable drill-carrying spindles and non-telescopic shafts connecting the driving and drill-carrying spindles in pairs.

13. The combination, with the frame B, having bearing b³, of the sleeve K mounted in said bearing and having adjustable collar K', loose collar K², and reduced threaded upper portion, the pinion L mounted on said sleeve, the nut K³ for clamping said pinion in place, the spindle J, free to move longitudinally in said sleeve and provided with groove j, and the key l, connecting said pinion, sleeve and spindle, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

AUGUST J. OEHRING.

Witnesses:

M. E. DAYTON,
IRVINE MILLER.