# United States Patent

McConnell

[15] 3,687,563

[45] Aug. 29, 1972


[54] **DRILLING MECHANISM**


[72] Inventor: **John R. McConnell,** 148 Woodside Ave., Ridgewood, N.J. 07450



[22] Filed: **May 19, 1970**

[21] Appl. No.: **38,669**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 737,654, June 17, 1968, Pat. No. 3,546,772.

[52] **U.S. Cl.** .....**408/39,** 408/46, 408/50, 408/236

[51] **Int. Cl.**.....**B23b 39/22,** B23b 41/00

[58] **Field of Search**.....408/39, 40, 41, 46, 49, 50, 408/52, 36, 37, 38, 236, 237, 238



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 754,321 | 3/1904 | Koeppen | 408/37 |
| 3,094,015 | 6/1963 | Mead | 408/39 X |
| 1,734,523 | 11/1929 | Klausmeyer | 408/237 |
| 2,945,402 | 7/1960 | Burg | 408/237 |
| 1,793,239 | 2/1931 | Miner | 408/49 |



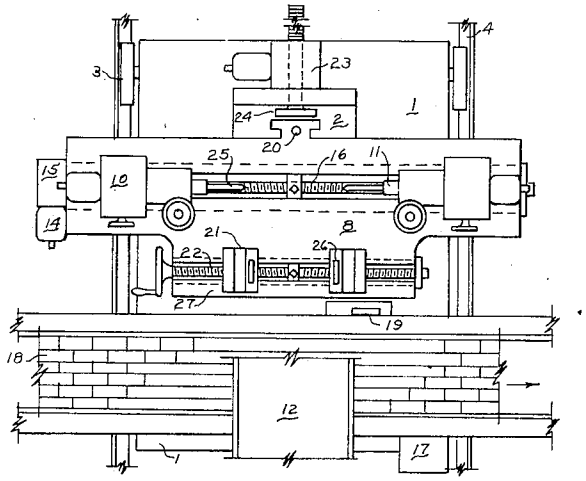
*Primary Examiner*—Francis S. Husar



[57] **ABSTRACT**

A drilling-conveying apparatus for the layout and fabrication of structural beams and girders comprising, dual mobile opposite hand co-ordinated drilling-conveying units, mounted on a common longitudinal supporting-guiding track and symmetrically spaceable thereon to any selected lateral spacing by a common right and left threaded relocating shaft, oppositely threaded through the bases of the said dual opposed units and longitudinally restrained by a mid-located floor-mounted anchor-bearing located between the rails of the said track, with the operating faces of the said units facing inwardly towards said anchor-bearing, each of said co-ordinated units having an integral vertical wall on the outer end of said base, vertically guiding a low elevateable transversely-extending platen supporting and guiding transversely convergible dual drill heads holding plural horizontal drills for simultaneously drilling both shape flanges and an adjustable-height vise to locate, elevate and hold a raw shape for precise drilling, a longitudinal ram projectible through said wall to length-center shapes between said dual units, a stationary forwardly-overhung drill head with transversely-disposed plural vertical drills for simultaneous drilling of the shape web, an integral transversely-operable multiple-strand chain-link conveyor means to transport the shapes forwardly into and out of the operating area, and powered moving, elevating, rotating, operating and control means.


**25 Claims, 13 Drawing Figures**



PATENTED AUG 29 1972

3,687,563

SHEET 1 OF 3

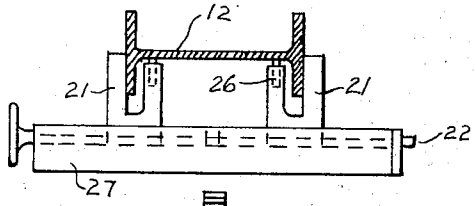



FIG. 3.

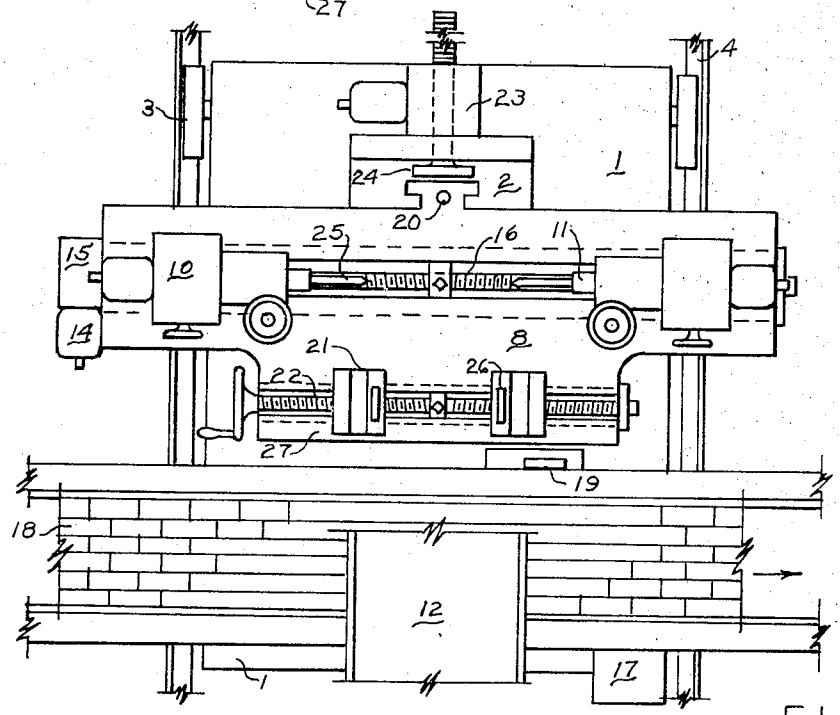



FIG. 1.

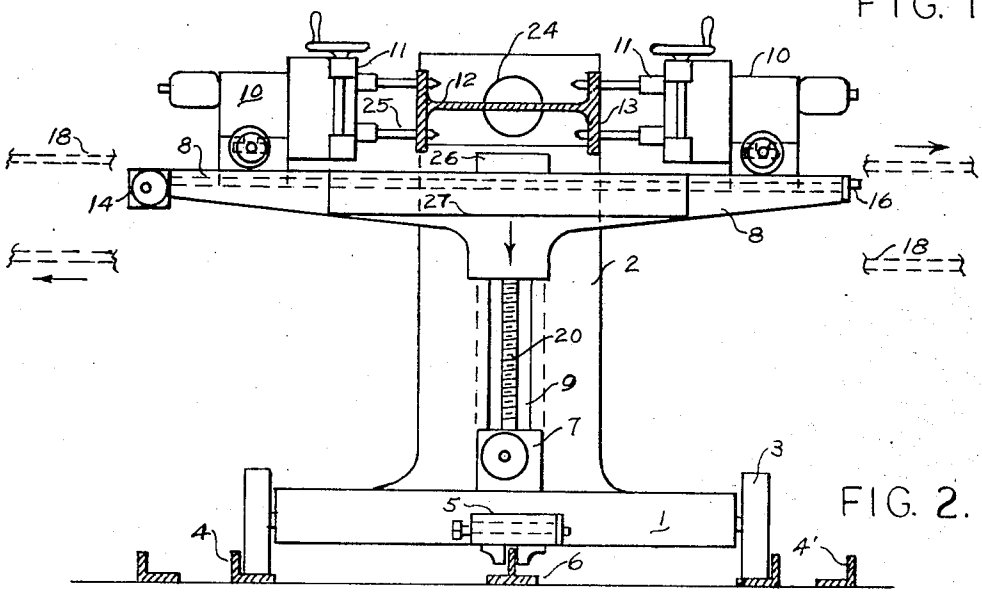



FIG. 2.

INVENTOR.

BY John R. McConnell

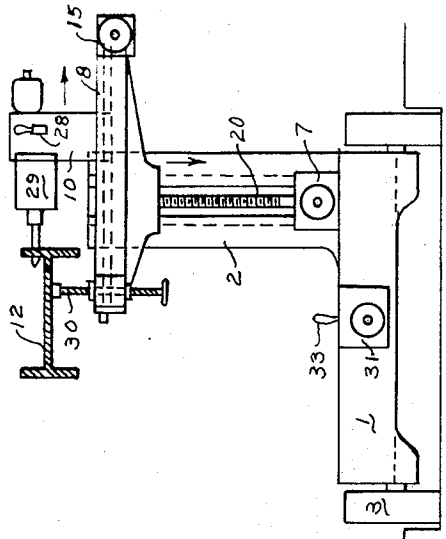


FIG. 4.

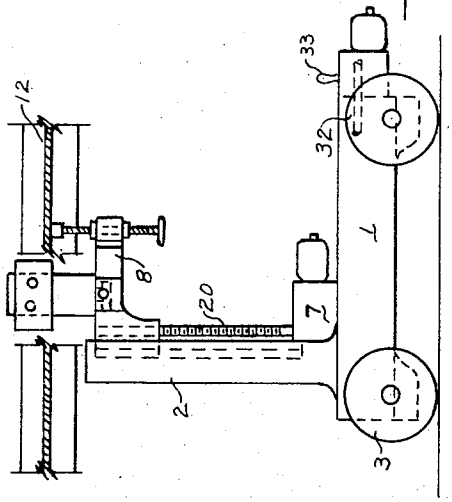


FIG. 5.

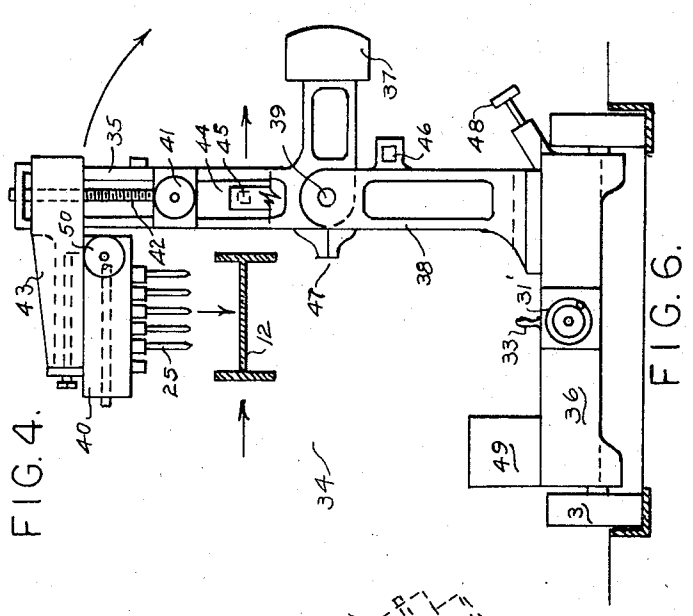


FIG. 6.

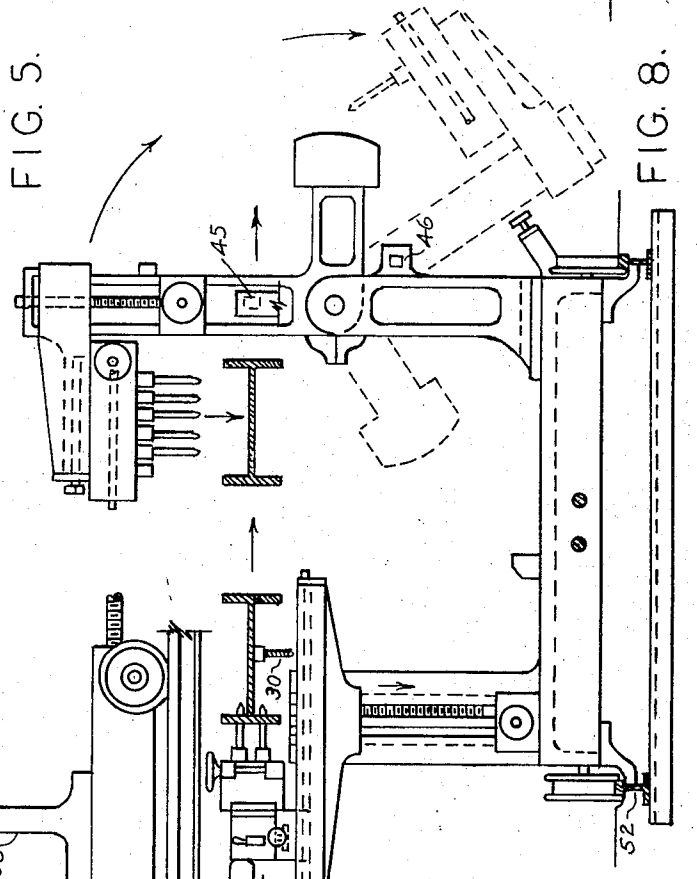


FIG. 8.

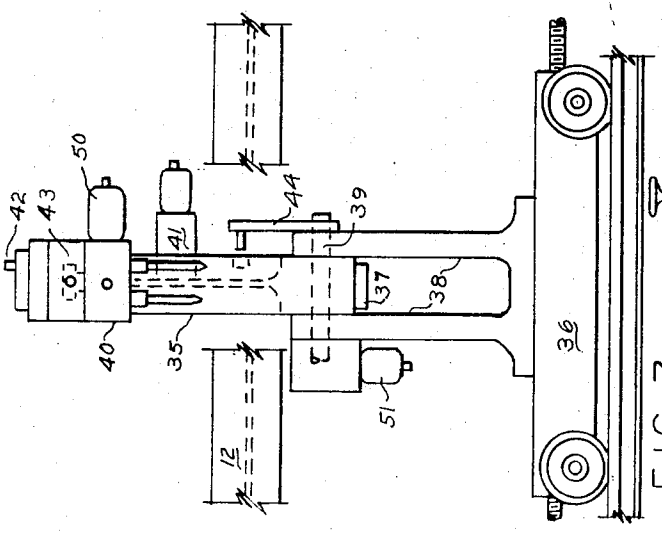


FIG. 7.

INVENTOR.

BY John K. McConnell

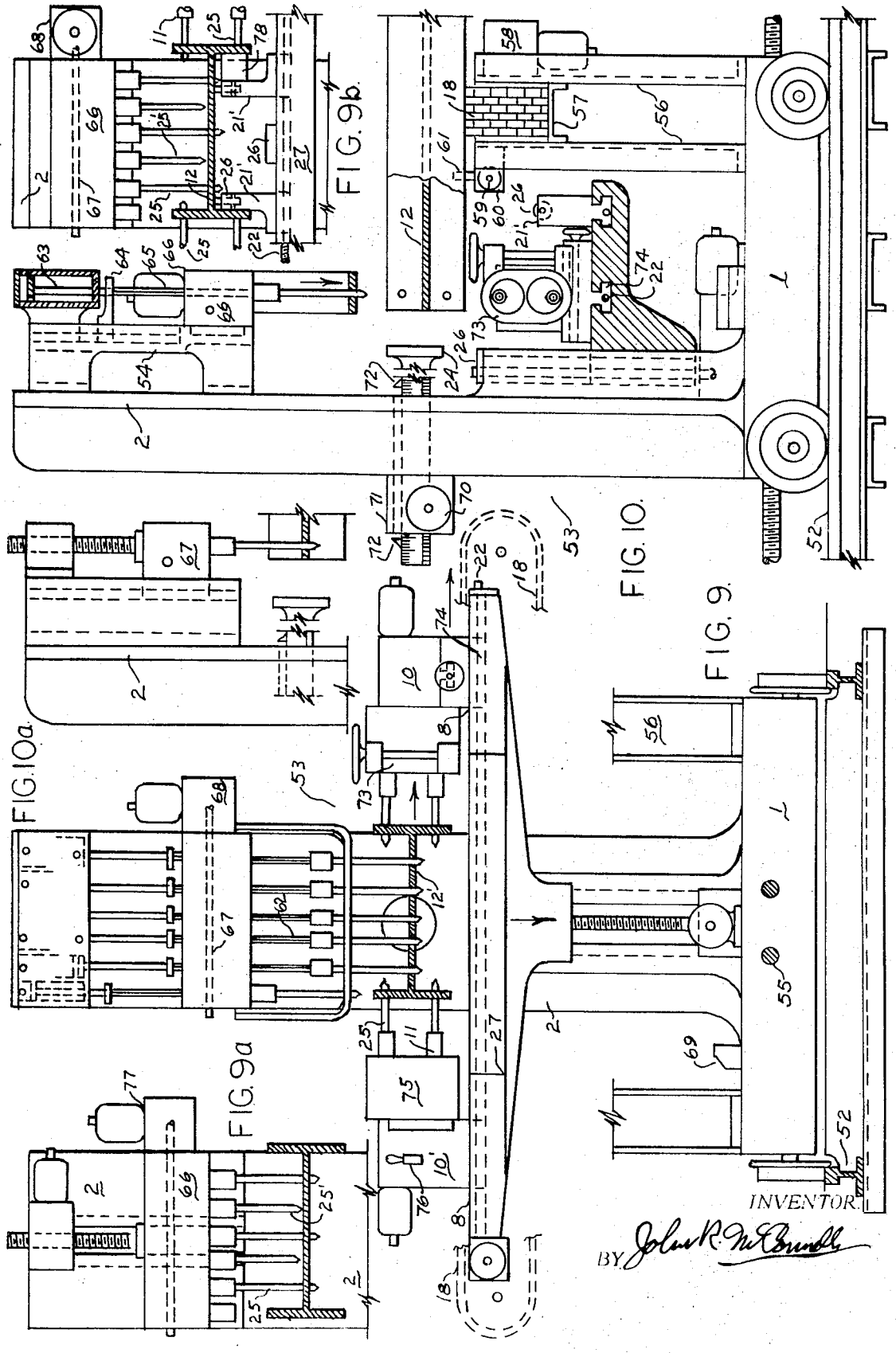


FIG. 9b

FIG. 10

FIG. 9

FIG. 10a

FIG. 9a

INVENTOR

BY John R. McBride

# DRILLING MECHANISM

This application is a continuation-in-part of co-pending application Ser. No. 737,654 of June 17, 1968, now process U.S. Pat. No. 3,546,772 of Dec. 15, 1970.

This invention relates to drilling mechanism units.

An objective is to provide co-ordinated plural drilling units to drill the web and/or flanges of structural building shapes at various selected points on their lengths

Another objective is to employ and operate these units simultaneously in a co-ordinated spaced plural longitudinal pattern as shown in the layouts of the parent process U.S. Pat. Nos. 3,546,772 and 3,606,658 with the work material moving transversely and consecutively into and beyond them to discharge in the transverse direction, although the various drilling units in some cases may be advantageously used singly.

It is also an objective to provide necessary integrated work conveyor means usually used dually.

A further objective is to provide adjustable mechanisms that will accommodate all lengths, depths, sizes and weights of structural shapes.

For other objectives and a better understanding of the invention reference may be had to the following detailed description taken in conjunction with the accompanying drawing showing typical application in which:

FIG. **1** is a plan view of an end operating flange drill.

FIG. **2** is a front elevation of said drill unit.

FIG. **3** is a front elevation of the shape clamping element.

FIG. **4** is an end elevation of an intermediately operating flange drill.

FIG. **5** is a side view of the intermediate flange drill.

FIG. **6** is an end view of a radially depressible intermediate web drill.

FIG. **7** is a side view of the said radially depressible web drill.

FIG. **8** is a double station flange and web combination drill.

FIG. **9** is a front elevation of an end operating combined web and flange drill.

FIG. **9***a* is an alternative web drill mechanism for FIG. **9**.

FIG. **9***b* is a second alternative web drill mechanism for FIG. **9**.

FIG. **10** is a side view of the combined drill taken on FIG. **9**.

FIG. **10***a* is a side view of the alternative mechanism of FIG. 9

FIG. **1–3** shows a mobile base **1** with integral back wall **2** mounted on wheels **3** operating in floor mounted angles **4** clamped to a centered position by a vise **5** on a guiding tee **6**. A power **7** elevatable horizontal platen **8** tee-keyed **9** to the forward side of the wall mounts dual transversely convergible drilling mechanisms **10** carrying plural dual variable-center drill spindles and chucks **11** for the drilling of the vertical shape **12** flanges **13**. Mechanism **10** are converged by powered **14** speed-reduction gear boxes **15** through a right and left common threaded shaft **16**. A powered **17** multiple strand endless shape conveyor belt **18** mounted above the tee of the base **1** forwards the raw shape **12** into the operating area against an adjustable depressible locating tab **19** detailed in FIG. **10** as item **61**. Platen **8** is raised by screw **20** and jaws of vice **21** are slightly closed against



shape by right and left threaded shaft **22** as powered **23** horizontal ram **24** is forwarded to correctly locate end of shape longitudinally in relation to the horizontal drills **25**. Replaceable various-diameter discs **26** are inserted in the inside tongues of vise to vertically place the center-line of web precisely at the mid-center height of the dual drills and to permit smooth easy shape movement. The dual vise is then tightened. Platen stop and shaft **20** bracket is shown at **26'**. Extended front part of platen is at **27**. Additional floor angles **4'** permit the substitution of double station fabricators typical of FIG. **8**.

FIG. **4–5** shows end and side views of an abbreviated version of FIG. **1–3** for the drilling of one flange of the shape intermediate of the ends thereof. These holes are required in certain members for the attachment of masonry-supporting spandrel angles, monorails or brackets. The powered drill mechanism **10** with speed and feed change lever **28** can accommodate a replaceable drill box **29** with any required number of horizontally or vertically spaced drill bits **25**. An adjustable feeler rod **30** wired to the motor **7** of shaft **20** slows and stops the upward travel of platen **8** to the proper height regardless of the sagging, wind or camber of the shape. A motor **31** geared **32** to the back axle propels the unit to the proper pre-locatable position, having a lever **33** to shift power to either wheel for steering on the general floor level outside of the trench.

FIG. **6** & **7** show an end and side view of a radially depressible drill press **34** for the web drilling of the shape intermediate of the ends thereof, and on the depressing of the upper drill post **35** by geared motor **51** and shaft **39** to permit the transverse overhead passage of the shape. It comprises a wheel mounted base **36** with short side-mounted drill post **38** journalling **39** the upper extending drill post **35** that carries a powered **50** downwardly projectable counter weighted **37** drill-head box **40** with plural drill spindles and drills **25**. Meter **41** and screw **42** moves the overhanging bracket **43**. Contact arm **44** through contacts **45** and **46** revolves post **35** from stop **47** to cushioning piston **48**. Hand wheel **31'** propels the unit. Counter weight **49** steadies against swing of drill-head **43**. Motor **51** powers the rotatable journalled shaft **39**.

FIG. **8** combines the flange and web drilling apparatus of FIG. **4** and **6** in a doubled station apparatus on the widened two rail **52** track.

FIG. **9–10** show respectively an end and side view of an end-operating combined flange and web drilling unit **53** mounted on rails **52**, comprising a forwardly projecting base **1** back wall **2** and bracket **54** supporting a forwardly-extended vertical web-drilling mechanism. Shaft **55** pre-locates the unit by means of the powered shaft threaded through the base. On the front of base dual posts **56** support a frame **57** around which the chain-link shape conveyor belt **18** travels powered by motor and speed reducer **58**. On the rear of the conveyor frame a hand wheel **59** and screw adjust the solenoid mounting **60** with step-tab **61** to locate the various depths of shapes in proper relation to the multiple drill spindles **62** by interrupting the current to the conveyor belt meter. On the upper bracket plural fluid cylinders, piston, and piston rods **63** vertically project the drills against the shape web. Non-rotatable piston rods are connected to a vertical guide **64**, tee-keyed to the wall

of the bracket with drill spindles connected to the guide. Splined drill spindles **65** extend through gear box **66** and are rotated by gears meshing with plural gears on the common gear box drive shaft **67** that is powered by motor and speed reducer **68**. Any number of drills can be used in any selected pattern simultaneously or consecutively. Standard structural spacing is three inches. Direct numerical reading dial box **69** on the base direct connected to the relocating shaft **55**, continuously indicates the distance the drills are located from the mid-length anshorage and transverse measuring axis. Thus twice the measurements indicated gives the effective working-length of the finished member **12'**. With shape transversely conveyed to the fabricating position under the drills, the matched and synchronized motors **70** on the rear back walls **2** of the opposed end units **53**, through the speed reducer gear boxes **71**, equally project the length-centering rams **24** against the opposite shape ends. The resistance when shape is length-centered stops the motors. Longitudinally adjustable dual pointers **72** in the top of the square shaft of rams indicate visually to scale if the overall length of shape falls within the permissible tolerance for maximum and minimum length of the member.

A wide transverse platen **8** tee-keyed **9** to the front of the back wall (shown in FIG. **2**) is elevatable vertically above the base by a motorized threaded shaft **20**. Opposed two spindle adjustable center horizontal drill mechanism **73** (shown at right) tee-keyed **74** into the horizontal upper surface of the platen are transversely convergible by motorized right and left threaded shaft **22** to drill the intermediately located shape flange **12**. An alternate type of replaceable drill box **75** with any number of plural drills **25** on fixed centers is shown at the left. It is bolted to the primary geared power drive box **10'** that has a gear lever **76** for various speeds and feeds. An adjustable stop **26'** limits the upward platen travel. FIG. **9***b* illustrates the shape vise **21'**.

FIG. **9***a* and **10***a* show an alternate arrangement of the drill box that is projected as a unit by motor-speed-reducer **77** employing long and short drills **25** and **25'** that economize in the elimination of gear changes for feed and speed.

FIG. **9***b* shows a simplified fixed drill head for maximum ruggedness and economy with elimination of much mechanism. Instead of the platen front **27** and vise **21'** lifting the shape **12** just clear of the conveyor belt and the drills then being projected down to the shape web for drilling of same, the platen and vise raise the shape the full height to permit the fixed drills to pierce the web. The horizontal drills fixed to the platen **8** function as before; illustrated in FIG. **10**. The vise is an internal two-tongued vise **21'** rather than four-tongued as shown in FIG. **3**. It is set symmetrically on the operating center-line of the unit and as holes are seldom drilled symmetrically in the web, it uses replaceable spacing blocks **78** on either tongue to properly offset the holes as required.

This group of related mechanisms have been intended and designed for co-ordinate use in co-operating plural numbers, as shown in the lay-outs of the parent co-pending process application Ser. No. 737,654 of June 17, 1968 now Pat. No. 3,546,772 of Dec. 15, 1970 and an accompanying continuation-in-part process application Ser. No. 737,786 now U.S. Pat. No. 3,543,374 filed simultaneously with this application in addition to Pat. No. 3,606,658 previously referred to. The end operating units would generally be used dually opposite-hand while the intermediate operating units can be used singly, dually or in plural numbers. Reference is respectfully directed to the above mentioned patents.

In this application the words given below shall have the definitions as listed:

shape or raw shape = a length of unfabricated steel, generally hot-rolled, of I or H cross-section suitable for fabrication as a floor member,

member = a shape that has been generally completely fabricated (drilled), ready for assembly-erection on a construction site,

random lengths = shapes of ordered length falling within a one-half inch length tolerance plus or minus,

working-length = the distance between the centers of the end holes of a drilled member,

perforate = to drill (or bore) completely through work material in one continuous action,

fabricate = to perform drilling and/or of the mechanical operations on a length of shape in the preparation of a member,

longitudinal = parallel to the longitudinal center-line of the structural shapes (work material) to be drilled

transverse = perpendicular to the longitudinal center-lines of the said shapes,

drill head & drill box = a powered geared mechanism for the simultaneous plural drilling of a shape by spaced plural drill bits held in plurally actuated spindles,

drilling mechanism = a completely integrated and constituted drilling unit that may also include a shape-conveying means.

What I claim as new and desired to protect by Letters Patent of the United States is:

**1**. A drilling mechanism for structural shapes comprising an integral base and back wall supporting a forwardly-hung power-elevatable horizontal platen mounting dual transverse symmetrically-convergible powered drilling heads carrying spaced plural drills for the simultaneous transverse perforating of both vertical flanges of the shape near the end.

**2**. A drilling mechanism as in claim **1** further comprising, an integral forwardly mounted powered transversely-operable shape-conveyor belt for transverse, forward movement of the shape into and out of the fabricating area.

**3**. A drilling mechanism as in claim **2** further comprising, a powered longitudinal forwardly-projectible shape-locating ram extending through said back wall to properly locate the end of the shape within relation to the said drills.

**4**. A drilling mechanism as in claim **3** further comprising, a transversely adjustable four pronged shape vise having projecting replaceable rollable discs of various diameters to vertically locate and lock the horizontal center line of web at the mid-height center-line of the paired said plural horizontal drills.

**5**. A drilling mechanism as in claim **4** further comprising base wheels a longitudinal track guiding means and self-powered pre-locating propulsion means.

6. An under-slung flange drilling mechanism comprising a mobile base having an integral vertical guiding wall for, an elevatable transversely and forwardly-hung horizontal platen carrying a powered transversely-projectible, multiple-spindle drilling mechanism head for the drilling of one flange of a shape intermediate of the ends thereof.

7. A flange drilling mechanism as in claim 6 further comprising a supporting-guiding track, self powered base propulsion means and a platen height-controlling web-contacting means.

8. A shape-web drilling mechanism comprising a mobile base having an integral short vertical post transversely power pivoting a shaft-mounted vertical upper drill post carrying an over-hung downwardly projectible drill box having powered plural drill spindles for the selectible drilling of various dimensions of shape webs, whereby the erected mechanism drills the shape web intermediate of the ends and retracts the upper assembly downwardly in a transverse vertical arc to permit the transverse forwarding of the over-head located completed member.

9. A combined double-station web and flange drilling mechanism comprising in combination the following means;

- a mobile common base having guiding and propulsion means,
- a transverse power-elevatable platen carrying a powered horizontal drilling head for the initial flange drilling of a structural shape and
- a powered overhung web-drilling means vertically power-depressible on a post which is arcuately power-pivotable on a short base-mounted post,
- for the co-ordinated simultaneous selective drilling of shapes of various dimensions and the successive downward arcing of the upper assembly out of the operating area for the forward transverse passage of the shape.

10. A drilling mechanism for structural shapes comprising in combination the following means, an integral base and back wall, a forwardly-hung transverse power-elevateable horizontal platen mounting a shape vise, an overhead forwardly-hung powered drill box having plural vertical powered drill spindles and drills for the simultaneous plural perforating of shape webs of various widths by elevation of the shape against the said drills by said vise and an integral forwardly-located base-mounted transversely operable powered shape-conveyor belt for consecutive forward transverse movement of shapes into and out of the fabricating area.

11. A drilling mechanism as in claim 10 further comprising, dual transverse symmetrically-convergible powered drilling heads on the said platen carrying paired plural drills for the simultaneous transverse perforating of the vertical flanges of the shape.

12. A drilling mechanism as in claim 11 further comprising, a powered longitudinal forwardly-projectible shape locating ram extending through said back wall to properly locate the end of the shape with relation to the said drills.

13. A drilling mechanism as in claim 12 further comprising, a guiding supporting means and pre-locating propulsion means.

14. A drilling mechanism as in claim 13, further comprising, short and long shank vertical drills for power conservation and mechanical simplicity, insertable replaceable roller discs of various diameters in tops of said vise jaws to locate the horizontal web center-line at mid-height center of said paired horizontal drills, replaceable spacer blocks of variable width on said vise jaws to locate shape eccentric to the said vertical drills, dual indicator tabs on said ram to check longitudinal location of shape and adjustable shape stop tab on conveyor frame to arrest transverse movement of shape.

15. A drilling mechanism as in claim 12 further comprising, a powered down wardly projectible drill box with plural drill spindles and drills of varied lengths which are projected as a unit to simultaneously drill the shape as required.

16. A drilling mechanism as in claim 12 further comprising a powered vertical drilling means in which selected plural drills in various numbers and patterns are downwardly power projected to simultaneously drill the shape web.

17. A drilling-conveying apparatus for the layout and fabrication of structural beams and girders comprising, dual mobile opposite-hand co-ordinated drilling-conveying units, mounted on a common longitudinal supporting-guiding track and symmetrically spaceable thereon to any selected lateral spacing by a common right and left threaded relocating shaft, oppositely threaded through the bases of the said dual opposed units and longitudinally restrained by a mid-located floor-mounted anchor-bearing located between the rails of the said track, with the operating faces of the said units facing inwardly towards said anchor-bearing, each of said co-ordinated units having an integral vertical wall on the outer end of said base, vertically guiding a low elevateable transversely-extending platen supporting and guiding transversely convergible dual drill heads, holding plural horizontal drills for simultaneously drilling both shape flanges and an adjustable-height vise to locate, elevate and hold a raw shape for precise drilling, a longitudinal ram, projectible through said wall to length-center shapes between said dual units, a stationary forwardly-overhung drill head with transversely-disposed plural vertical drills for simultaneous drilling of the shape web, an integral transversely-operable multiple-strand chain-link conveyor means to transport the shapes forwardly into and out of the operating area, and powered moving, elevating, rotating, operating and control means.

18. A drilling-conveying apparatus as in claim 17 further comprising, co-ordinated dual mobile drill presses symmetrically spaced and respaceable from the said central anchor-bearing and within the outer-located said units, on said common track by a separate similar right and left threaded relocating shaft threaded through the bases of said drill presses, each of said co-ordinated drill presses having a mobile base with integral short post, pivoting in a transverse vertical arc a shaft-mounted vertical upper drill post carrying transversely disposed vertical plural drills, for the selectable simultaneous drilling of various dimensions of shape webs intermediate of the ends by the erected said drill means, which is then retracted downwards below the level of the shape on the said conveyors, for the continued forward passage of the completely fabricated member and additional powered interlocked operating means.

19. A drilling-conveying apparatus as in claim 17 further comprising, co-ordinated dual elevateable underslung drill means, symmetrically re-spaceable from the said central anchor-bearing and within the outer-located said units on said common track, by a separate similar right and left threaded relocating shaft oppositely threaded through the bases of the said underslung drill means, each of said co-ordinated underslung drill means having a mobile base with short integral transverse wall, mounting and vertically guiding an elevateable transversely-extending platen carrying and transversely guiding a drill head with plural horizontal drills, for the precise plural drilling of the adjacent vertical flange of the shape intermediate of the ends thereof, an adjustable height web feeler attached to the said platen for vertical centering of said horizontal drills, and additional powered interlocked operating means.

20. A drilling-conveying apparatus for the layout and fabrication of structural beams and girders comprising, dual mobile opposite-hand co-ordinated drilling-conveying units mounted in a common longitudinal supporting-guiding means and laterally spaceable therein to any required spacing, with the operating faces of said units facing inwardly to each other, each of said co-ordinated units having an integral vertical wall on the outer end of a wheel-equipped base, which is fitted with a vise for locking said unit on a transversely-centered floor-anchored longitudinal rail, the said wall vertically guiding a low elevatable transversely-extending platen, supporting and guiding transversely convergible dual drill heads holding plural horizontal drills, for simultaneously drilling both shape flanges, an adjustable-height vise to locate, elevate and hold a raw shape for precise drilling, a longitudinal ram projectible through said wall to length-center shapes between said dual units, a transversely-operable multiple-strand chain-link conveyor means to transport the shapes forwardly into and out of the operating area and powered moving, elevating, rotating, operating and control means.

21. A drilling-conveying apparatus as in claim 20 further comprising, co-ordinated dual mobile drill presses laterally spaceable between the outer-located said dual units in the said common supporting guiding means, each of said co-ordinated drill presses having a mobile base with location-locking vise operable on said anchor rail, said base having an integral short post pivoting in a transverse vertical arc a shaft-mounted vertical upper drill post, carrying transversely disposed vertical plural drills for the selectable simultaneous drilling of various dimensions of shape webs, intermediate of the ends by the erected said drill means, which is then retracted downwards below the level of the shape on the said conveyors, for the continued forward passage of the completely fabricated member and additional powered interlocked operating means.

22. A drilling mechanism for structural shapes comprising an integral base and vertical back wall, supporting and vertically guiding a low transverse forwardly hung power-elevatable horizontal platen, for the mounting and transverse symmetrical powered guidance of dual opposed transversely-spaced symmetrically-convergible powered drilling heads, carrying precisely-spaced plural horizontal drills, for the transverse simultaneous perforating of both vertical flanges of the shape near the end, and an integral powered transversely-operable shape-conveyor belt mounted above the forward toe of said base, for the successive straight-line transverse movement of the shape into and out of the drilling area.

23. A drilling mechanism as in claim 22 further comprising, a powered longitudinal forwardly-projectible shape-locating ram extending through the said back wall, to dimensionally locate the end of the shape with relation to the said drills.

24. A drilling mechanism as in claim 23 further comprising, a transversely-convergible shape vise having replaceable rollable discs of various diameters in the tops of the inner tongues of the jaws, to vertically locate and lock the horizontal center-line of the web of shape at the center-line of the paired said plural drills, to permit smooth minor length-wise adjustment of the shape and to rigidly hold the shape for drilling.

25. A drilling mechanism for structural shapes comprising, an integral base and back-wall supporting and vertically guiding an overhung forwardly-mounted drill head, downwardly projectible by power means, said drill head carrying plural vertical transversely-disposed powered drill bits for the simultaneous multiple perforating of the web of a shape, an integral powered transversely-operable shape-conveyor belt mounted above the forward toe of said base, for the successive straight-line forward transverse movement of the shape into and out of the drilling area, and a powered longitudinal shape-locating ram extending through the said back wall to dimensionally locate the end of the shape with relation to the said drills.

* * * * *