No. 648,734. Patented May 1, 1900.

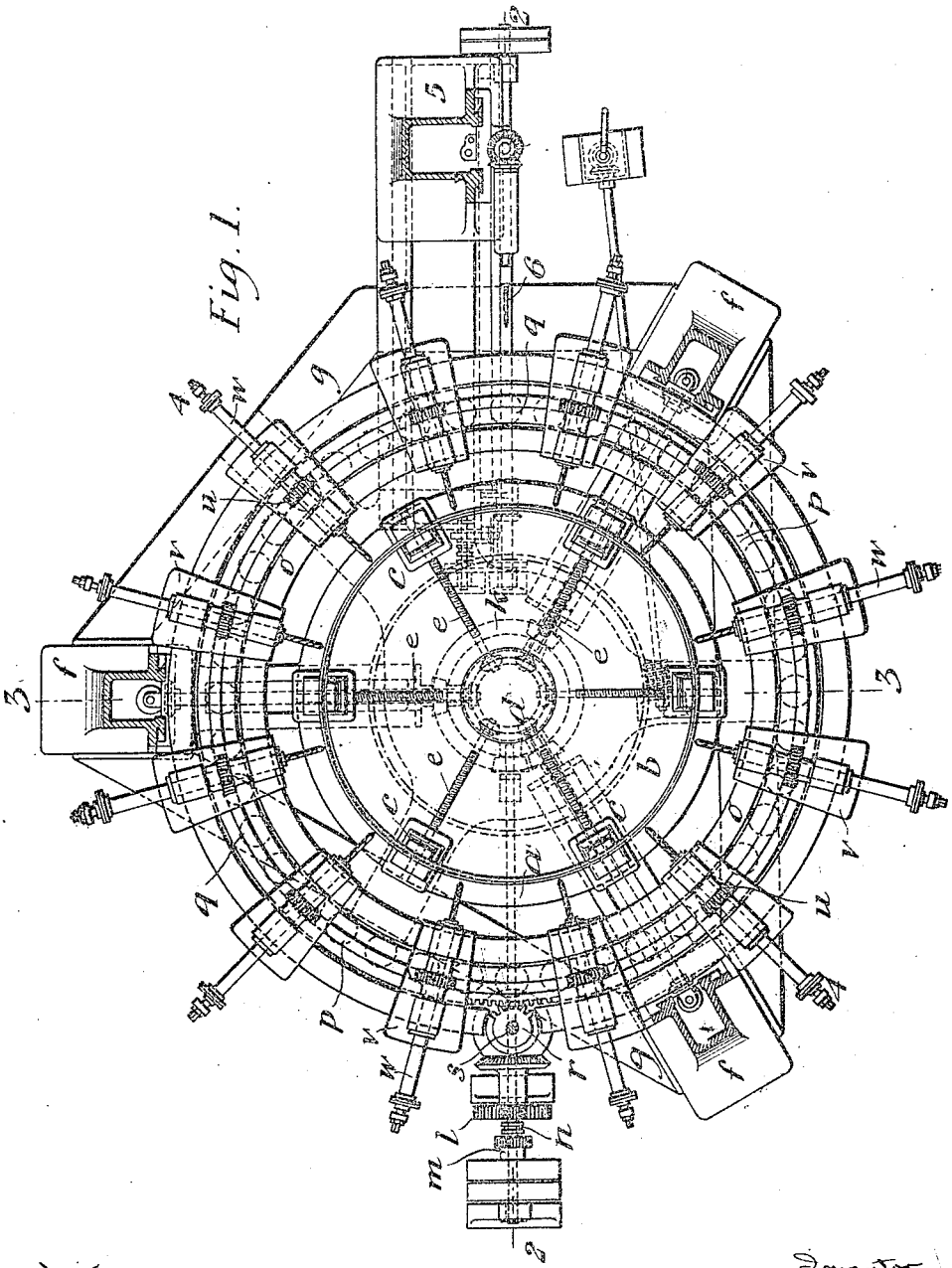
J. Y. FOSTER.

MULTIPLE DRILL APPARATUS FOR CYLINDRICAL BOILER OR OTHER SHELLS.

(Application filed Sept. 25, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses
R. B. Morris

Inventor
James Y. Foster
By James L. Norris
Atty

No. 648,734. Patented May 1, 1900.

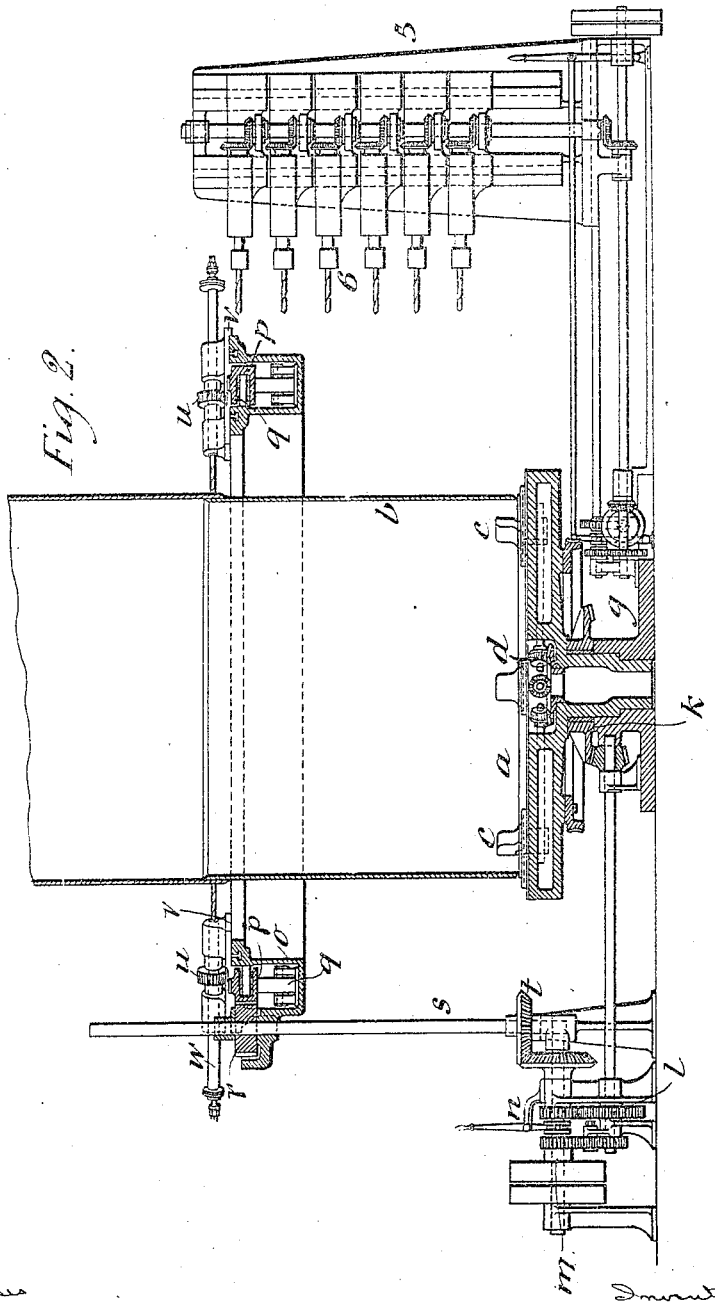
J. Y. FOSTER.

MULTIPLE DRILL APPARATUS FOR CYLINDRICAL BOILER OR OTHER SHELLS.

(Application filed Sept. 25, 1899.)

No Model.) 3 Sheets—Sheet 2.

Fig. 2.



Witnesses
R. R. Norris

Inventor
James Y. Foster
by James L. Norris
Atty

No. 648,734. Patented May 1, 1900.

J. Y. FOSTER.

MULTIPLE DRILL APPARATUS FOR CYLINDRICAL BOILER OR OTHER SHELLS.

(Application filed Sept. 25, 1899.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

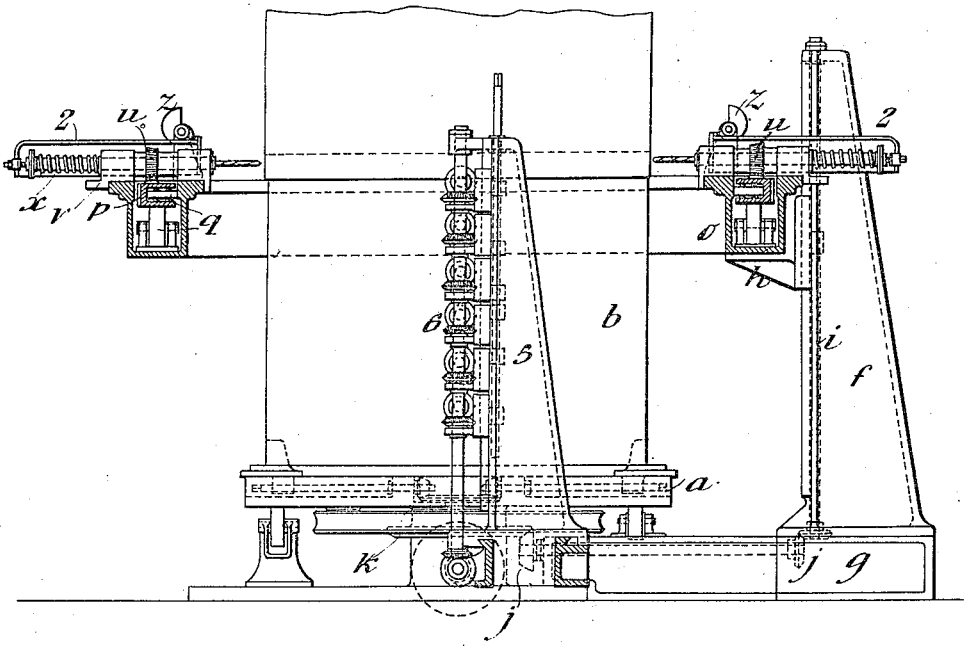
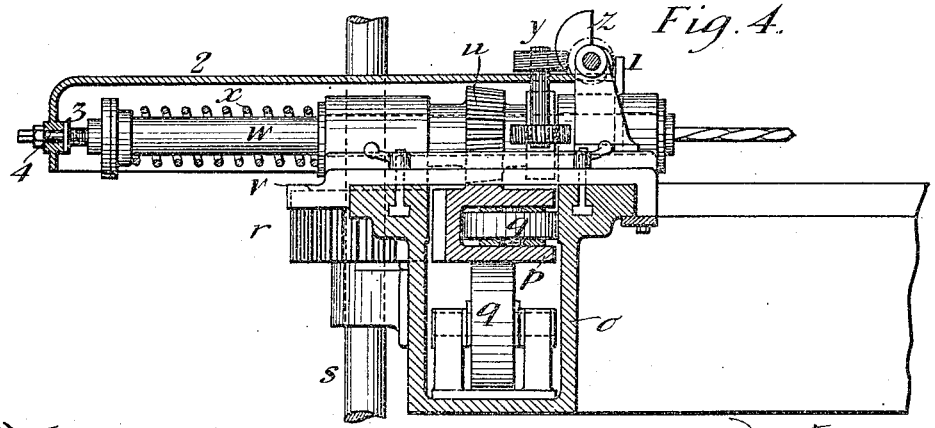


Fig. 4.



Witnesses
R. R. Norris

Inventor
James Y. Foster
By James L. Norris
Atty

UNITED STATES PATENT OFFICE.

JAMES YATES FOSTER, OF PRESTON, ENGLAND.

MULTIPLE DRILL APPARATUS FOR CYLINDRICAL BOILER OR OTHER SHELLS.

SPECIFICATION forming part of Letters Patent No. 648,734, dated May 1, 1900.

Application filed September 25, 1899. Serial No. 731,600. (No model.)

To all whom it may concern:

Be it known that I, JAMES YATES FOSTER, a citizen of England, residing at Soho Foundry, Preston, in the county of Lancaster, England, have invented certain new and useful Improvements in Multiple Drill Apparatus for Cylindrical Boiler or other Shells, (for which I have applied for a patent in Great Britain, dated March 2, 1899, No. 4,618,) of which the following is a specification.

This invention relates to improvements in drilling-machines in which several drills are operated at one time in the same circumferential or longitudinal seam of a boiler or other cylindrical shell.

By this invention it is possible to use simultaneously a larger number of drills than have hitherto been used, while having them always radially directed. The gearing necessary for operating the large number of drills which can be accommodated on this machine is also much simpler than in the previous machines of this class.

I shall describe the machine, referring to the accompanying drawings.

Figure 1 is a plan. Figs. 2 and 3 are vertical sections, partly in elevation, on the lines 2 2 and 3 3, respectively, of Fig. 1; and Fig. 4 is a sectional elevation of one of the circumferential drill-heads drawn to an enlarged scale.

The drills in Figs. 1 and 2 are shown without the covers and springs, which are clearly shown in Figs. 3 and 4.

On a circular turn-table *a* the shell *b* to be drilled is clamped by several screw-clamps *c*, worked simultaneously by suitable gear *d*, connecting the screw-spindles *e*, any one of which can be turned by a handle applied to its outer end. On each of three strong standards *f*, fixed to the base-frame *g*, is fitted a vertically-sliding bracket *h*, all three being moved simultaneously by upright screws *i*, which are connected by bevel-gear *j* to a central wheel *k*, connected through reversing-gear *l* to a wheel on the main driving-shaft *m*, with which it can be engaged by a clutch *n* when it is desired to raise or lower the brackets *h*. These sliding brackets *h* carry an annular frame *o*, in which revolves an annular wheel *p*, supported and guided by anti-friction-bowls *q*. This wheel *p* has on one side teeth gearing with a pinion *r*, which slides vertically with the ring frame *o* on a shaft *s*, driven by bevel-gear *t*, which can be clutched to the main horizontal driving-shaft *m*. On the upper face of the wheel *p* are bevel-teeth which gear with pinions *u* on the drill-spindles. On the top of the annular frame *o*, each free to be moved around it, are a number of carriages *v*, capable of being clamped in position where desired. Each of these carriages *v* carries a radial drill-spindle *w*, each spindle being grooved for a key in the bevel-pinion *u* which drives it, through which it can slide while it turns with it.

Each drill-spindle has its own feeding mechanism advancing it in opposition to a spring *x*, which gives a quick return of the drill-spindle when it has completed its forward stroke, air-cushions being preferably provided to deaden the shock of return; but as these form no part of this invention they are not shown. The feeding mechanism of each drill consists of a worm on the drill-spindle *w* driving a worm-wheel on a vertical spindle *y*, a worm on which drives the shaft of a cam *z*, which acts on a projection 1 from a yoke 2, that is connected to an adjusting screw-spindle 3, screwed into the drill-spindle, the end of this screw-spindle freely turning in a bearing 4, at the end of the yoke 2.

A supplementary standard 5, carrying a number of radial drills 6, arranged vertically over each other and capable of vertical adjustment, is attached to the machine for drilling the longitudinal seams; but to this no claim is made as any part of the present invention.

In the machine above described the drilling apparatus is external to the shell; but when for shells of large diameter the drills, with their mounting and gearing, may be arranged internally, the frames *v*, which carry the drill-spindles, being turned half-around, so as to point the drills outward instead of inward.

Having now particularly described and ascertained the nature of this invention and the best means I know for carrying the same into practical effect, I claim—

1. In multiple drill apparatus for cylindrical shells and the like, the combination with a plurality of standards and brackets vertically adjustable thereon, of a ring frame car-

ried by said brackets, having an annular channel therein, an annular wheel fitting and rotatable in said channel and provided with two sets of teeth, a driving-pinion carried by said ring frame and meshing with one set of said teeth and a plurality of drill-spindles mounted in said ring frame and provided with pinions meshing with the other set of said teeth.

2. In multiple drill apparatus, for cylindrical shells and the like, the combination with a plurality of standards and brackets vertically adjustable thereon, of a ring frame carried by said brackets, having an annular channel therein, an annular wheel fitting and rotatable in said channel and provided with two sets of teeth, supporting and guiding antifriction-bowls for said wheel, a driving-pinion carried by said ring frame and meshing with one set of said teeth and a plurality of drill-spindles mounted in said ring frame and provided with pinions meshing with the other set of said teeth.

3. In multiple drill apparatus, a plurality of drill-spindles, pinions having a key-and-groove connection therewith, an annular wheel having teeth thereon meshing with said pinions, and means for turning said wheel, in combination with a worm on each of said spindles, a shaft, a worm-wheel on said shaft meshing with said worm, a cam carried by a shaft mounted in fixed supports, a worm-wheel on the cam shaft meshing with a worm on said vertical shaft, an adjusting screw-spindle connected with the drill-spindle, a yoke in which said screw-spindle freely turns, a projection on said yoke adapted to be engaged by said cam, and a spring for resisting the forward longitudinal movement of the drill-spindle, as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JAMES YATES FOSTER.

Witnesses:
W. M. HARRIS,
GERALD L. SMITH.