

ILLUSTRATED CATALOGUE

--OF--

Metal-Working Machine Tools

... ALSO ...

Steam Hammers,
Hydraulic Machinery, Etc.

MANUFACTURED BY

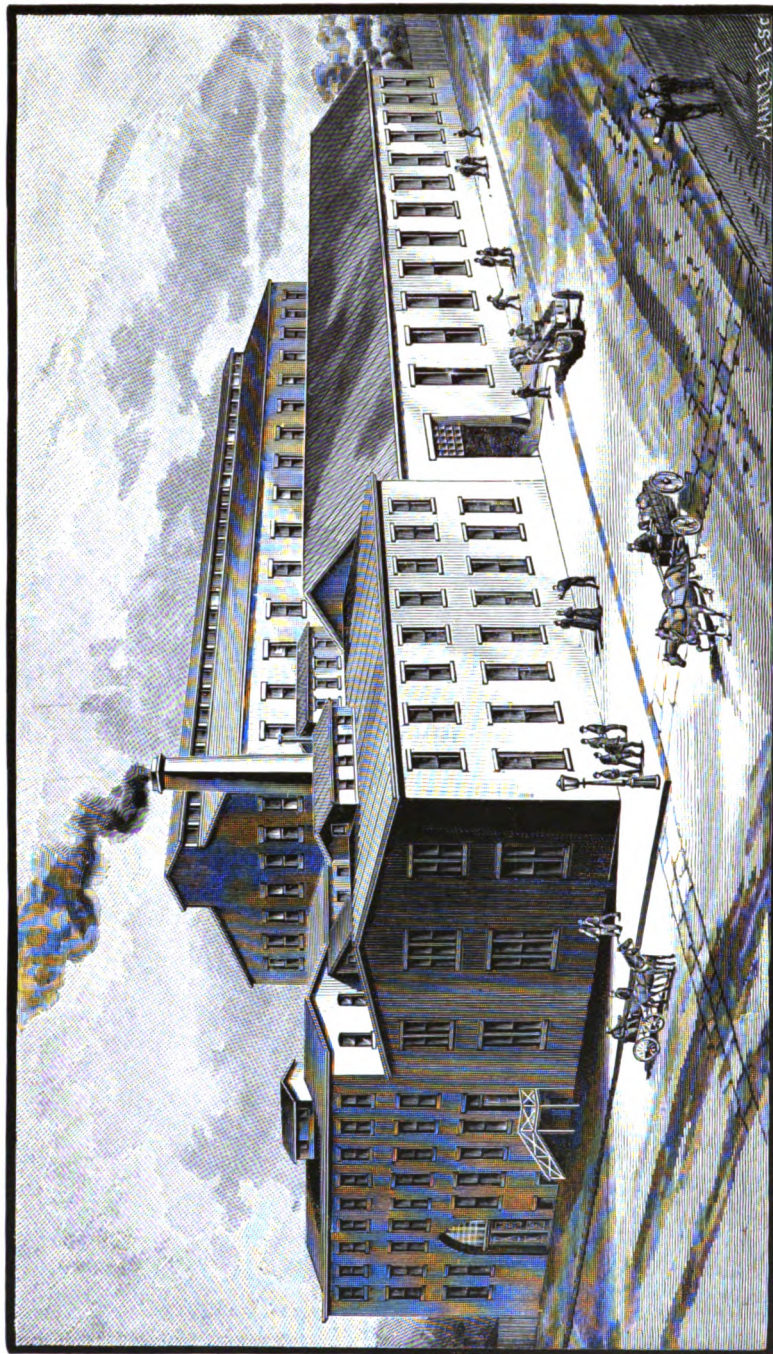
BEMENT, MILES & CO.

ENGINEERS AND MACHINISTS,

PHILADELPHIA, PA., U. S. A.

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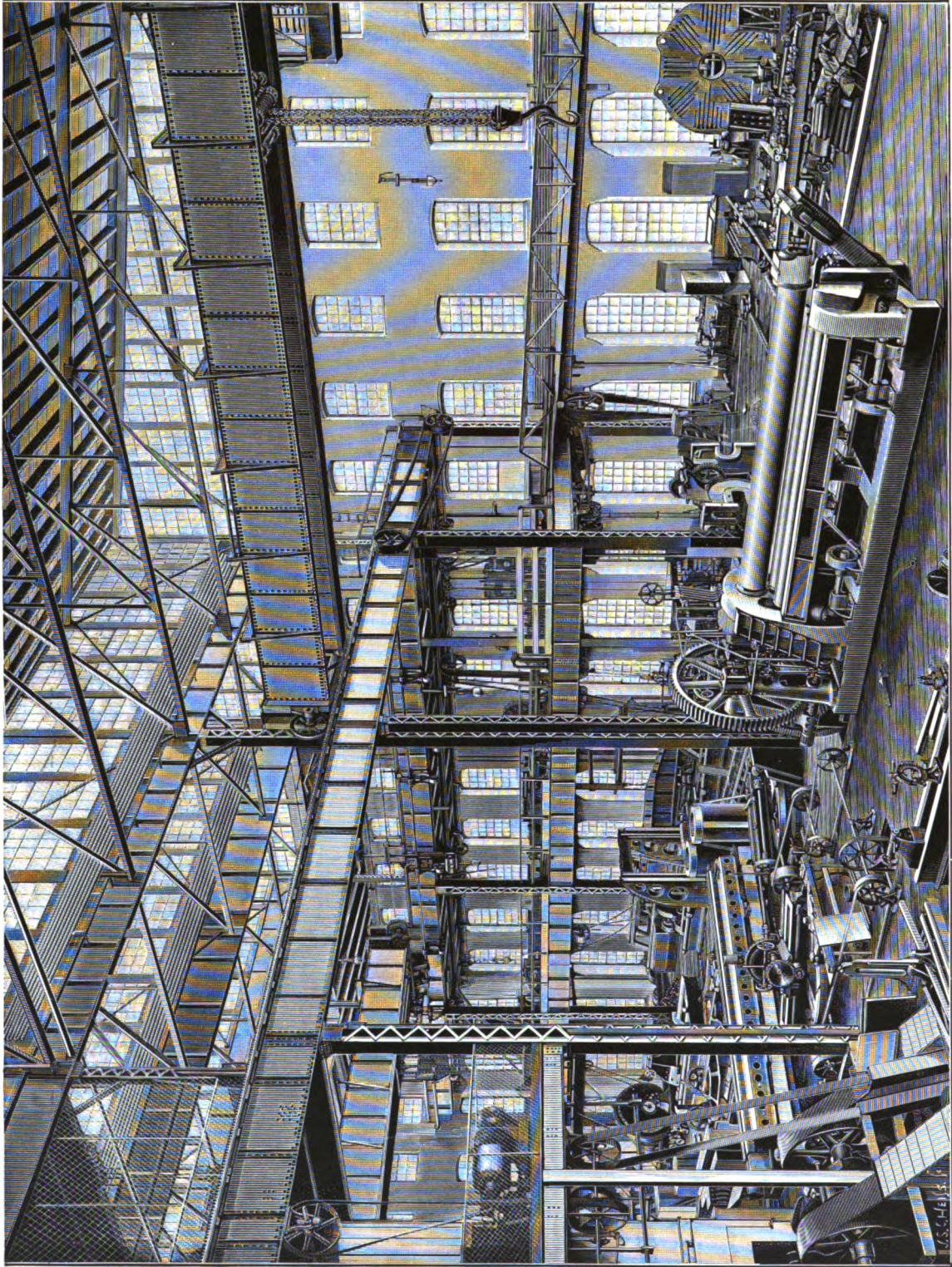
TWENTY-FOURTH STREET WORKS.

INTRODUCTORY REMARKS.

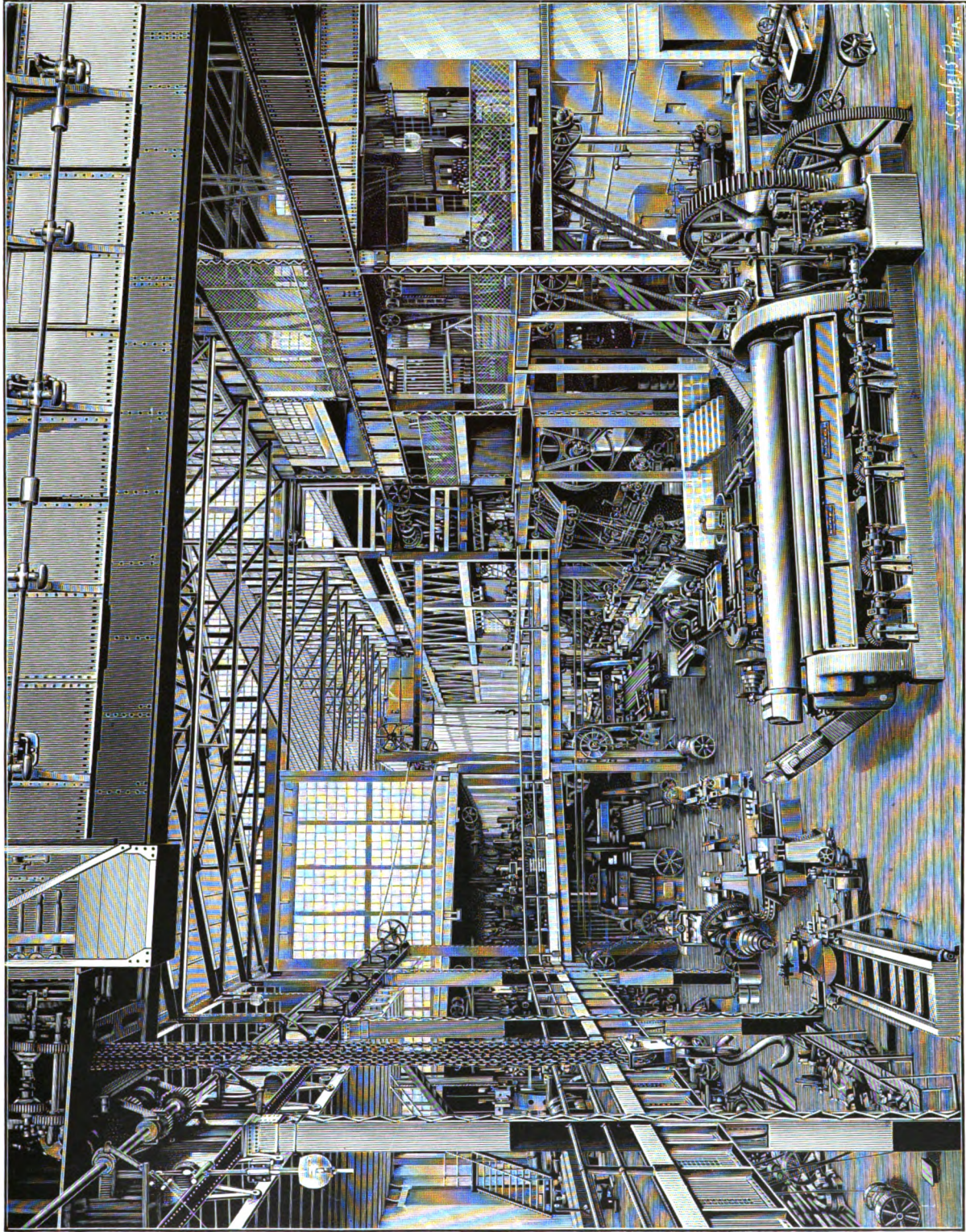
OWING to the rapid development of our business, the necessity for an illustrated catalogue, representing the extensive line of machine tools manufactured by us, becomes more and more apparent. Hitherto we have been content to use selected photographs, or an indexed and paged album of the same, more or less complete: but, the inadequacy of the one and the expense, as well as trouble, involved in the other, have induced us to prepare the book which we now offer to our friends and customers. We have been further stimulated to this undertaking by the unusually frequent applications received within the last few years from every direction. Though the list of illustrations is very extensive, it by no means comprises all the varieties of tools which have been built by us; and, moreover, as improvements are constantly making, applications should be sent us for photographs showing the latest arrangements. The descriptions given are general rather than complete, but further information will always be given to customers who desire it.

Our works were established in 1848, though no particular attention was paid to machine building until 1851, when the then small establishment was entirely diverted to that branch of business. From the start until the present time, it has been the endeavor of the management to produce the best designs and workmanship, with the view of supplying the wants of those customers only who require machines of the most perfect construction.

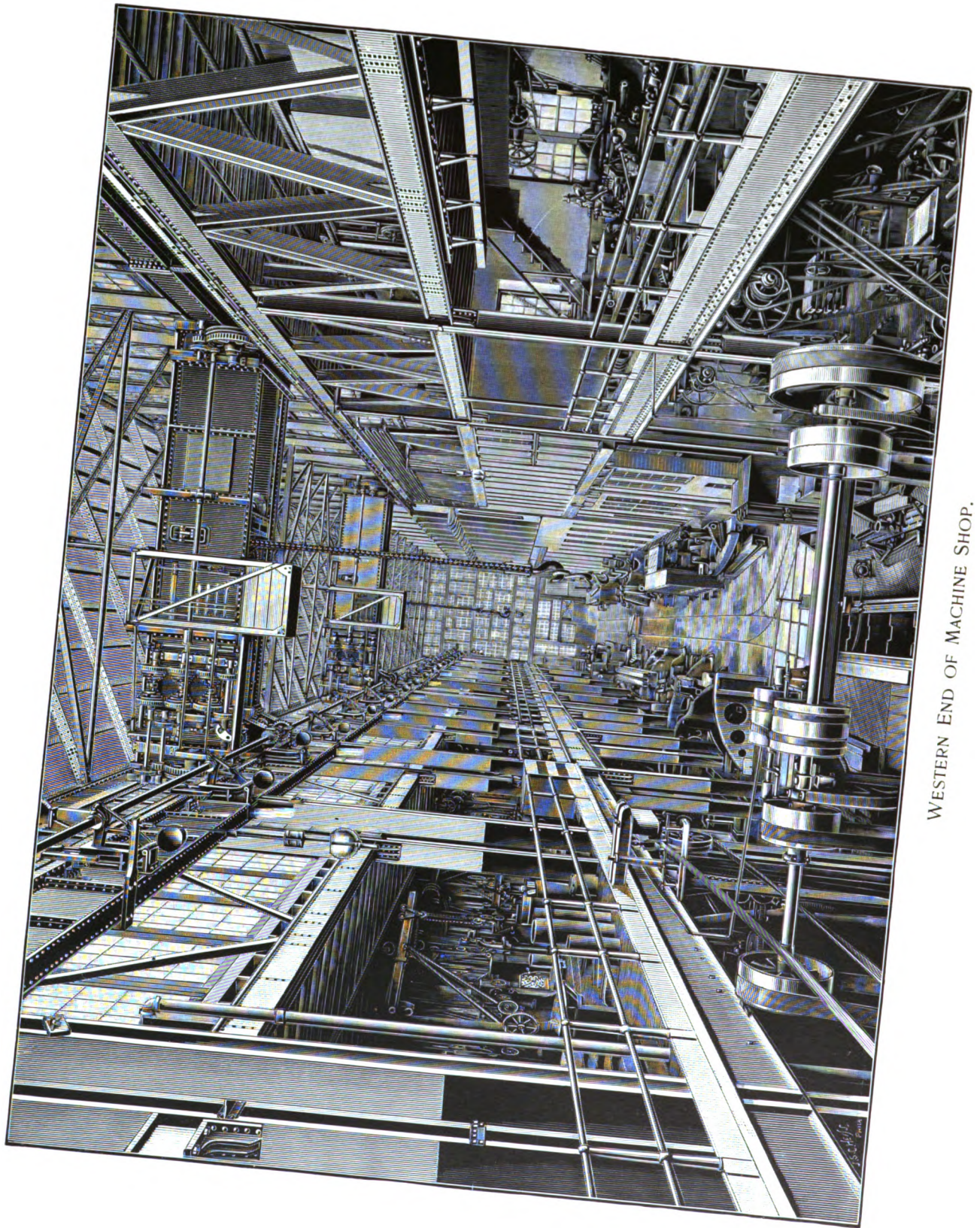
Our success has been largely due to the constant employment of a corps of efficient engineers, draughtsmen, shop inspectors, and skilled mechanics, many of them long in our service and thoroughly familiar with their work; also to the use of standard gauges, and the best appliances to produce correct work. The design and construction of large special tools are now important branches of our business. For this reason we have made extensive additions to our equipment, which is now quite equal to the present demand, and will be further enlarged to meet the future requirements of the business. By using our present facilities fully, we can employ over one thousand workmen.



MAIN ERECTING SHOP — EASTERN END.



WESTERN PORTION OF ERECTING SHOP.

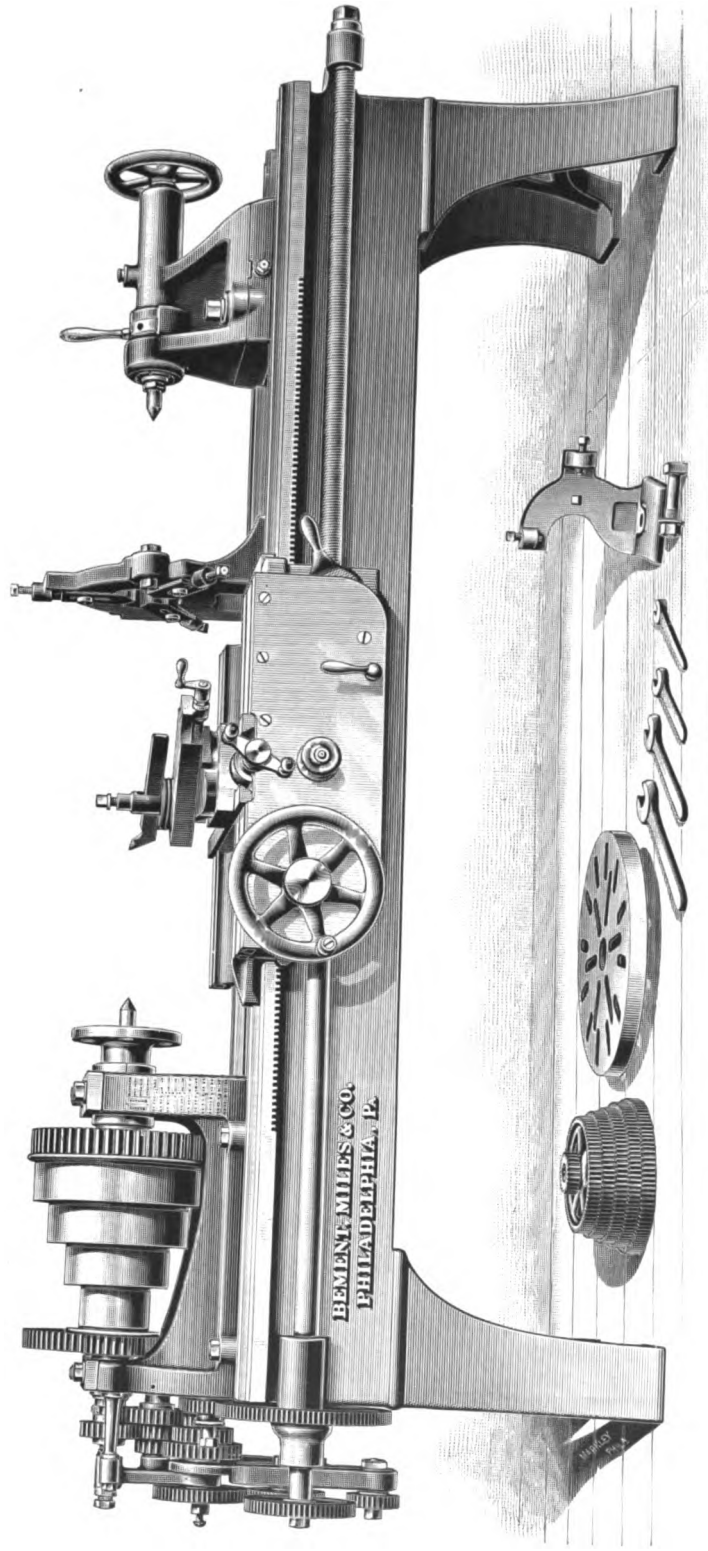


WESTERN END OF MACHINE SHOP.

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LATHES.



21-INCH LATHE

18-INCH LATHE

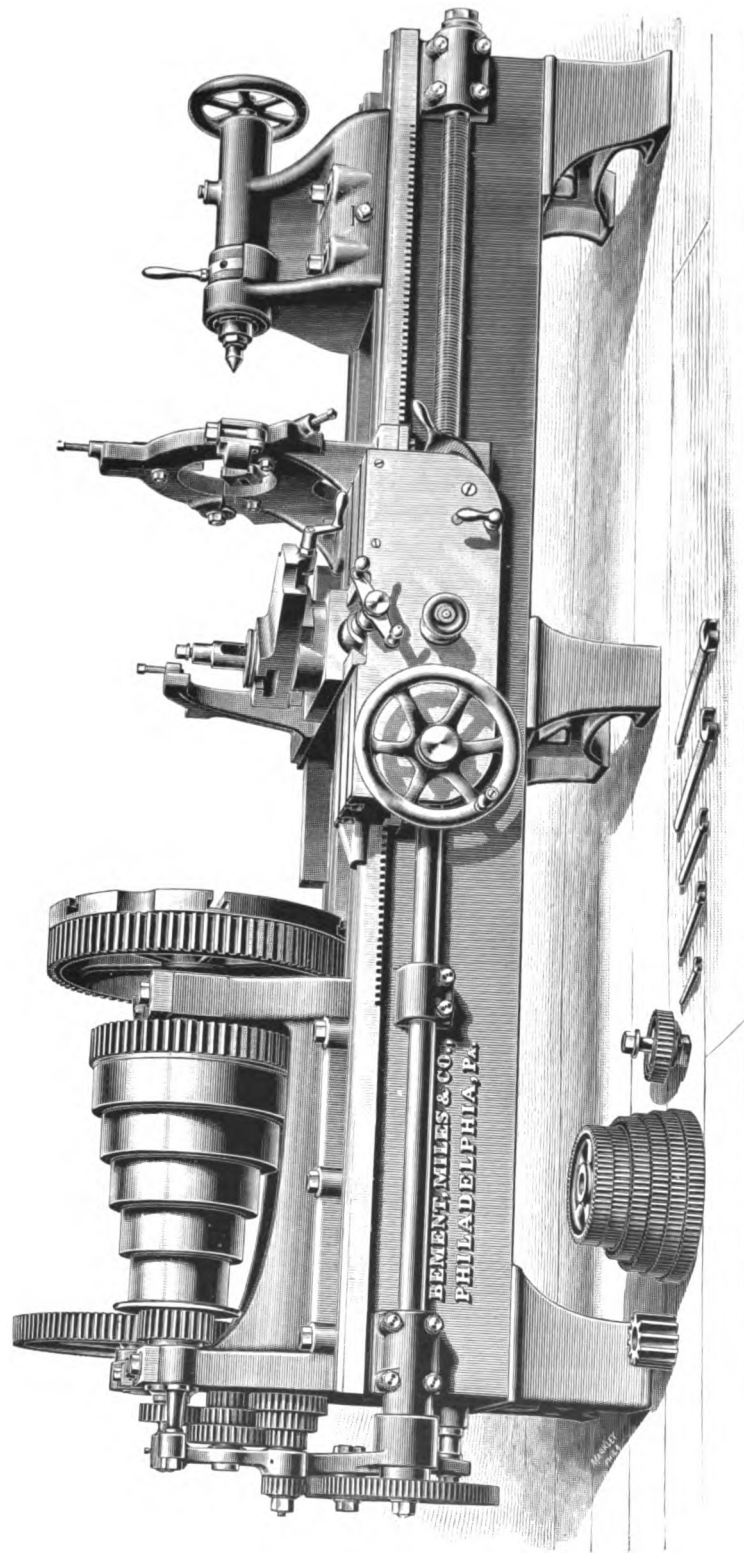
Swings $18\frac{1}{4}$ inches over bed and $13\frac{1}{4}$ inches over rest carriage. The bed can be made of any desired length; when 7 feet long, the lathe will admit 3 feet 9 inches between centres. Driven by large and wide-faced cone with back gearing, giving eight motions to face plate. Spindles are steel, of large diameter, supported in long heads, having ample bearings of best gun metal, with adjustment for wear.

Carriage has long bearing upon V-surfaces on bed, and sliding head has a similar bearing to keep it in correct alignment. Hand movement of carriage by gearing and steel rack on bed; power movement in either direction by handle traversing with it. Upper part of sliding head arranged with transverse slide for taper turning. Feeds are positive, operated by gearing and splined steel screw, connected with spindle by cone gearing, having a sliding clutch pin, which provides three variations of feed without changing wheels. Independent screw-cutting feeds, separately driven, the thread of lead screw being used for this purpose only. Feeds instantly changed from screw-cutting to turning, or vice versa, with safety lever, preventing the possibility of throwing both kinds of feed into gear at one time. Steady rest, follower rest, screw change gearing, countershaft and wrenches included.

21-INCH LATHE

Swings $21\frac{1}{4}$ inches over bed and $13\frac{3}{4}$ inches over rest carriage. The bed can be made of any desired length; when 10 feet long, the lathe will admit 6 feet between centres. Cone has four changes, and is back geared, giving eight motions to face plate. Spindles are steel, of large diameter, supported in long heads having ample bearings of best gun metal, with adjustment for wear.

Carriage has long bearings upon V-surfaces, and sliding head has a similar bearing to keep in correct alignment. Hand movement of carriage by gearing and steel rack on bed; power movement in either direction by handle traversing with it. Upper part of sliding head arranged with transverse slide for taper turning. Positive longitudinal and facing feeds, operated by gearing and splined steel screw, connected with spindle by cone gearing having a sliding clutch pin, which provides three variations of feed without changing wheels. Independent screw-cutting feeds, separately driven, the thread of lead screw being used for this purpose only. Feeds instantly changed from screw cutting to turning, or vice versa, with safety lever, preventing the possibility of throwing both kinds of feed into gear at one time. Clamp for fastening carriage to bed when facing feeds are used, compound slide rest, steady rest, follower rest, screw gearing, countershaft and wrenches included.



30-INCH LATHE.

25-INCH LATHE.

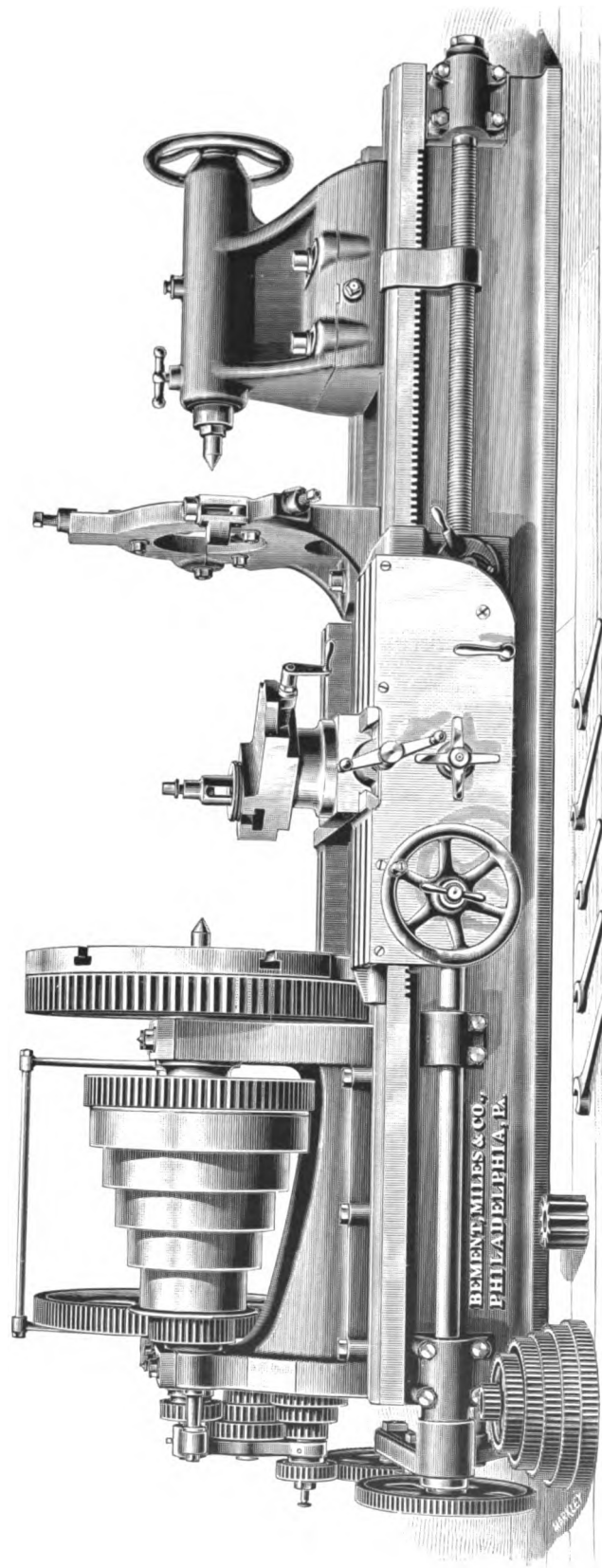
Swings $26\frac{1}{4}$ inches over bed and $17\frac{3}{4}$ inches over rest carriage. Bed can be made of any desired length; when 12 feet long, the lathe will admit 6 feet 11 inches between centres. Cone has four changes for wide belt, and is back geared and geared into face plate, giving twelve different speeds (if preferred, a five-change cone and plain face plate, giving ten speeds, may be used). Spindles are of steel, of large diameter, supported in long heads having ample bearings of best gun metal, with adjustment for wear.

Carriage has long V-bearings on bed, and sliding head has a similar bearing to keep it in correct alignment. Hand movement of carriage by gearing and steel rack on bed; power movement in either direction by handle traversing with it. Upper part of sliding head arranged with transverse slide for taper turning. Positive longitudinal and facing feeds, operated by gearing and splined steel screw, connected with spindle by cone gearing having a sliding clutch pin, which produces three variations of feed without changing wheels. Independent screw-cutting feeds, separately driven, the thread of lead screw being used only for this purpose. Feeds instantly changed from screw cutting to turning, or vice-versa, with safety lever, preventing the possibility of throwing both kinds of feed into gear at one time. Clamp for fastening carriage to bed when facing feeds are used. Compound slide rest, steady rest, follower rest, screw gearing, countershaft and wrenches included.

30-INCH LATHE.

Swings 31 inches over bed and $21\frac{1}{2}$ inches over rest carriage. Bed can be made of any desired length; when 14 feet long, the lathe will admit 8 feet between centres. Cone has five changes for wide belt, and is back geared and geared into face plate, giving fifteen different speeds. Spindles are of steel of large diameter, supported in long heads having ample bearings of best gun metal, with adjustment for wear.

Carriage has long bearings upon V-surfaces, and sliding head has a similar bearing to keep it in correct alignment. Hand movement of carriage by gearing and steel rack on bed; power movement in either direction by handle traversing with it. Upper part of sliding head arranged with transverse slide for taper turning. Positive longitudinal and facing feeds, operated by gearing and splined steel screw connected with spindle by cone gearing having a sliding clutch pin, which produces three variations of feed without changing wheels. Independent screw-cutting feeds, separately driven, the thread of lead screw being used only for this purpose. Feeds instantly changed from screw cutting to turning, or vice-versa, with safety lever, preventing the possibility of throwing both kinds of feed into gear at one time. Clamp for fastening carriage to bed when facing feeds are used. Compound slide rest, steady rest, follower rest, screw gearing, countershaft and wrenches included.



42-INCH LATHE.

36-INCH LATHE.

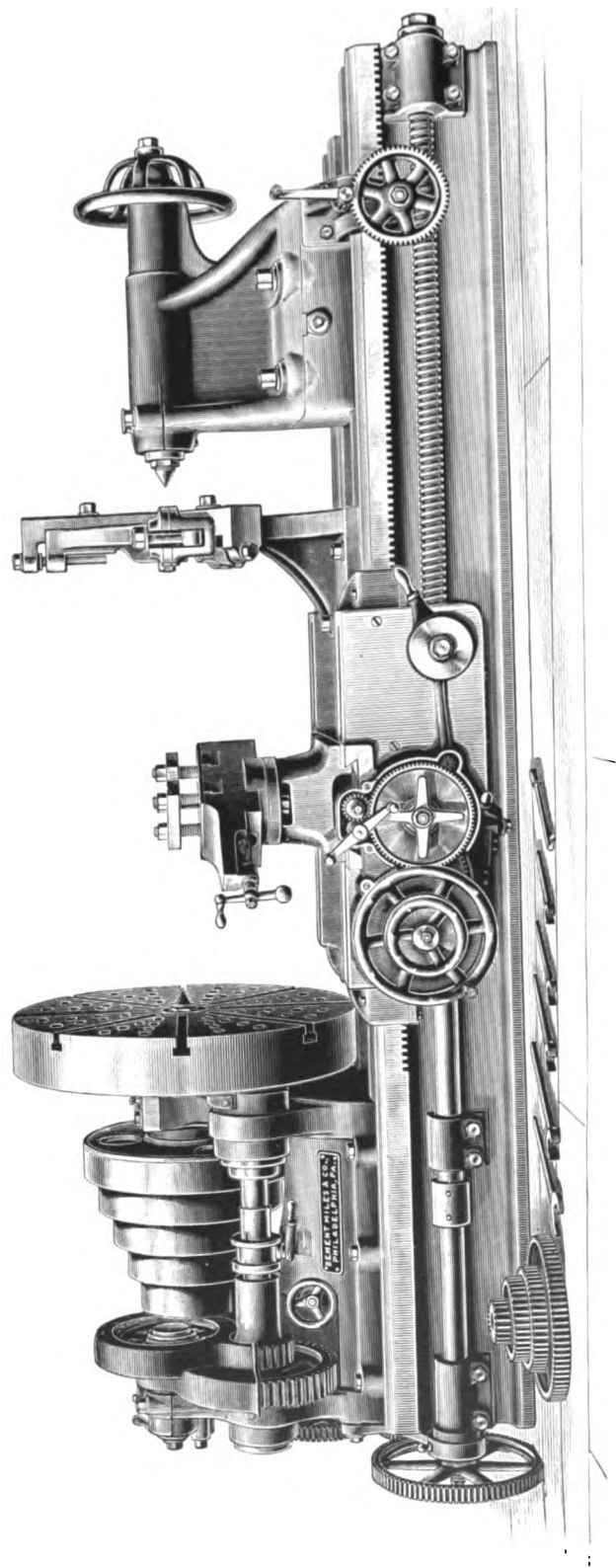
Swings 37 inches over bed and 26 inches over rest carriage. Bed can be made of any desired length ; when 14 feet long, the lathe will admit 7 feet 7 inches between centres. Cone has five changes for wide belt, and is back geared and geared into face plate, giving fifteen different speeds. Spindles are of steel of large diameter, supported in long heads having ample bearings of best gun metal, with adjustment for wear.

Carriage has long bearings upon V-surfaces, and sliding head has a similar bearing to keep it in correct alignment. Hand movement of carriage by gearing and steel rack on bed ; power movement in either direction by handle traversing with it. Upper part of sliding head arranged with transverse slide for taper turning. Positive longitudinal and facing feeds, operated by gearing and splined steel screw connected with spindle by cone gearing having a sliding clutch pin, which produces three variations of feed without changing wheels. Independent screw-cutting feeds, separately driven, the thread of lead screw being used only for this purpose. Feeds instantly changed from screw cutting to turning, or vice-versa, with safety lever, preventing the possibility of throwing both kinds of feed into gear at one time. Clamps for fastening carriage to bed when facing feeds are used. Compound slide rest, steady rest, follower rest, screw gearing, countershaft and wrenches included.

42-INCH LATHE.

Swings 43 inches over bed and 31 inches over rest carriage. Bed can be made of any desired length ; when 16 feet long, the lathe will admit 9 feet 2 inches between centres. Cone has five changes for wide belt, and is back geared and geared into face plate, giving fifteen different speeds. Spindles are of steel of large diameter, supported in long heads having ample bearings of best gun metal, with adjustment for wear.

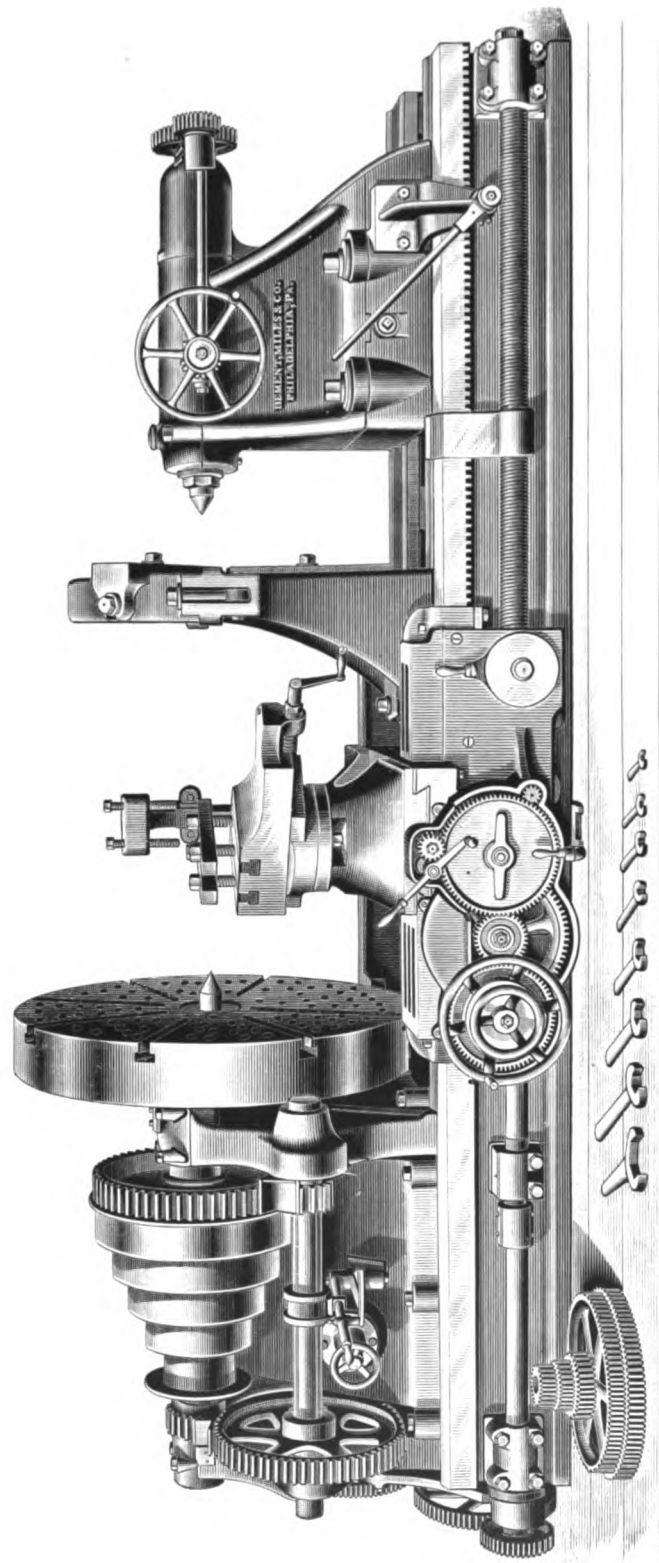
Carriage has long bearings upon V-surfaces ; and sliding head has a similar bearing to keep it in correct alignment. Hand movement of carriage by gearing and steel rack on bed ; power movement in either direction by handle traversing with it. Upper part of sliding head arranged with transverse slide for taper turning. Positive longitudinal and facing feeds, operated by gearing and splined steel screw, connected with spindle by cone gearing having a sliding clutch pin, which produces three variations of feed without changing wheels. Independent screw-cutting feeds, separately driven, the thread of lead screw being used only for this purpose. Feeds instantly changed from screw cutting to turning, or vice-versa, with safety lever, preventing the possibility of throwing both kinds of feed into gear at one time. Clamp for fastening carriage to bed when facing feeds are used. Compound slide rest, steady rest, follower rest, screw gearing, countershaft and wrenches included.



50-INCH LATHE.

50-INCH LATHE.

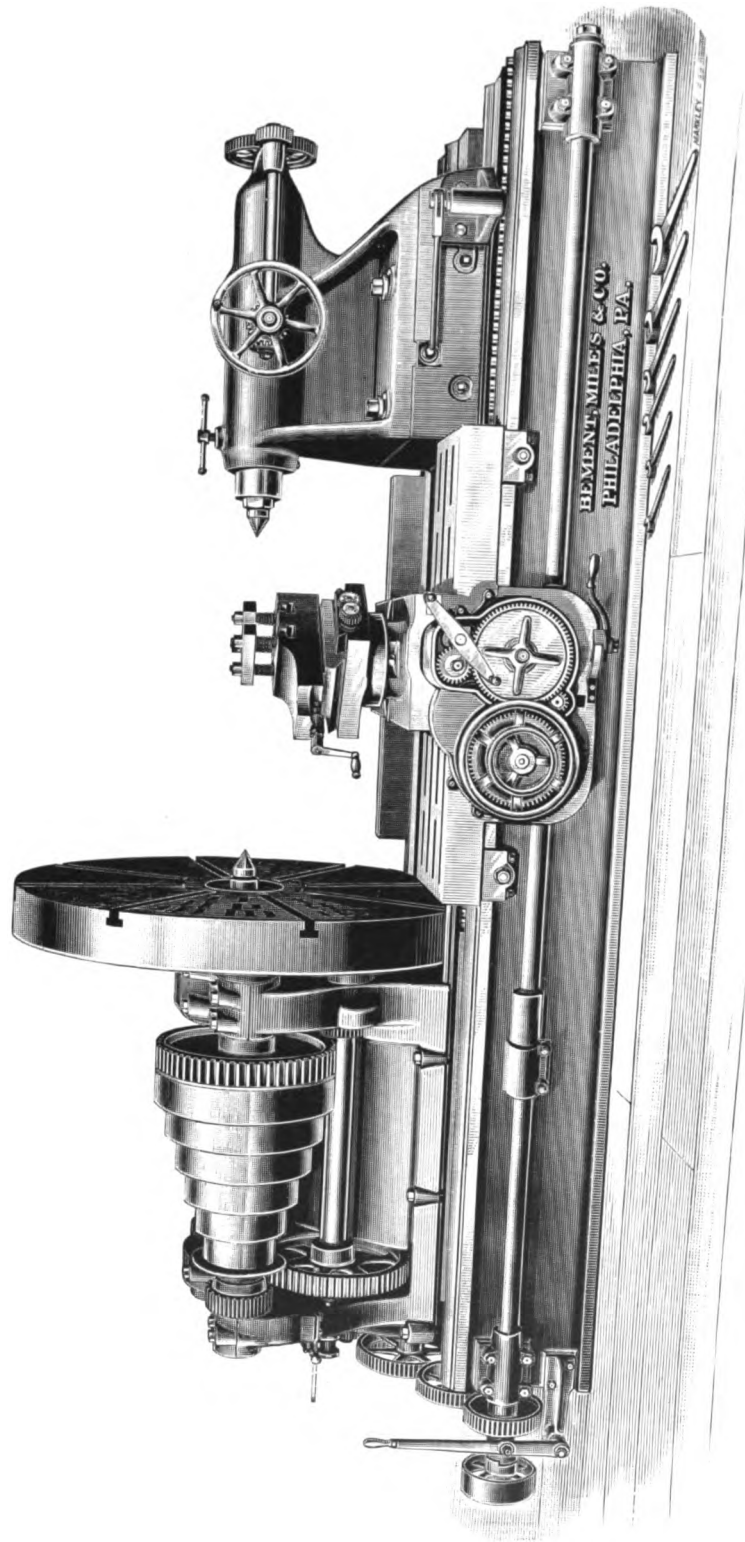
Swings 50 inches over bed and 42 inches over rest carriage. Bed can be made of any required length; when sixteen feet long the lathe will admit 8 feet 2 inches between centres. Cone has five changes for wide belt, is back geared, and geared into internal face plate, giving fifteen changes of speed. Spindles are of steel of large diameter, supported in long heads, having ample bearings of gun metal, with adjustment for wear. Centres of heads are moved backward to provide a solid support for the tool slide on bed when turning large diameters. Carriage has long bearings upon broad V's; hand movement by gearing connected with steel rack on bed; power movement in either direction by reversible handle. Sliding head traversed on bed by rack and gearing; upper part of same arranged with transverse slide for taper turning. Automatic longitudinal, transverse and angular feeds operated by gearing and splined steel screw having three changes without changing gears. Screw-cutting feeds separately driven, the thread of lead screw being used only for this purpose, and so arranged that they cannot be thrown into gear at the same time with the turning feeds. Includes compound rest steady and follower rests, screw change gearing, countershaft and wrenches.



63-INCH LATHE.

63-INCH LATHE.

Swings $63\frac{1}{2}$ inches over bed and 53 inches over rest carriage. Bed can be made of any required length; when 18 feet long, the lathe will admit 7 feet 4 inches between centres. Cone has five changes for wide belt, is back geared, and geared into internal face plate, giving twenty changes of speed. Spindles are of large diameter, supported in long heads, having ample bearings of gun metal, with adjustment for wear. Centres of heads are moved backward to provide a solid support for the tool slide on bed when turning large diameters. Carriage has long bearings upon broad V's; hand movement by gearing connected with steel rack on bed; power movement in either direction by reversible handle. Sliding head traversed on bed by rack and gearing; upper part of same arranged with transverse slide for taper turning. Automatic longitudinal, transverse and angular feeds operated by gearing and splined steel screw having three changes without changing gears. Screw-cutting feeds separately driven, the thread of lead screw being used only for this purpose, and so arranged that they cannot be thrown into gear at the same time with the turning feeds. Includes compound rest, steady and follower rests, screw change gearing, countershaft and wrenches.



84-INCH LATHE.

72-INCH LATHE.

Swings 73 inches over bed and 55 inches over carriage. Bed can be made of any desired length; when 20 feet long, the lathe will admit 9 feet 6 inches between centres. Cone has six changes for wide belt, and is back geared and geared into large internal spur wheel on face plate, giving to spindle twelve motions, which may be increased to twenty-four by shifting the overhead belts. Spindles are of large diameter, with long bearings, having the necessary adjustment for wear. Bed has three slides for carriage, affording a solid support to the tool rest in all positions. Longitudinal feeds are by screw, situated within the bed, and cross and angular feeds by splined rod, etc., in front of bed, each being automatic, positive and reversible, having three changes without changing wheels. Tool rest has a compound movement; hand motion of carriage by steel rack on bed, through suitable gearing. Upper part of sliding head has lateral adjustment for taper turning. Countershaft and wrenches included.

84-INCH LATHE.

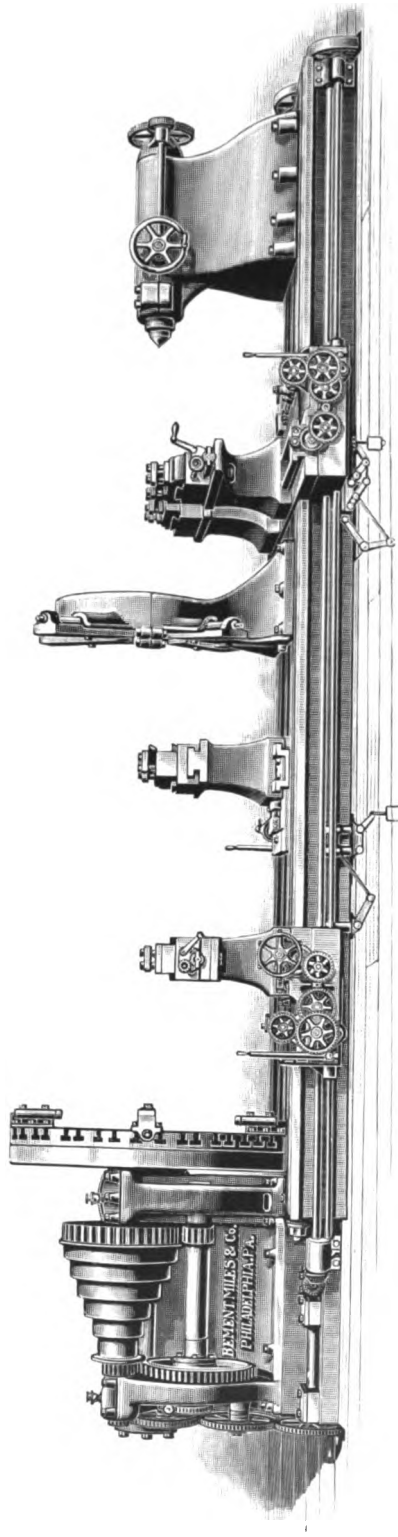
Swings 85 inches over bed and $51\frac{1}{2}$ inches over carriage, the upper central portion of which can be removed when desired, increasing the swing to 72 inches. Bed can be made of any desired length; when 22 feet long, the lathe will admit 10 feet 6 inches between centres. Driven by large and wide-faced cone of six changes, back geared and geared into face plate, giving twelve motions to spindle, or double the number by the specially arranged countershaft. Spindles are of large diameter, with long bearings, having the necessary adjustment for wear. Bed has three slides for carriage, affording solid support to the tool in all positions. Longitudinal facing and angular feeds have three reversible changes without changing gears; and carriage is provided with a rapid power movement on bed. Tool rest has a compound movement; hand movement of carriage by hand wheel connected with rack on bed. Sliding head is traversed on bed by pinion connected with feed rack on inner shear, the movement being facilitated by slightly elevating the head on rollers bearing on eccentric studs. Countershaft and wrenches included.

96-INCH LATHE.

Swings 97 inches over bed and 66 inches over carriage, the upper central portion of which can be removed when desired, increasing the swing to 80 inches. Bed can be made of any required length; when 24 feet long, the lathe will admit 12 feet between centres. Driven by large and wide-faced cone of six changes, back geared and geared into face plate, giving twelve motions to spindle, or double the number by the specially arranged countershaft. Spindles are of large diameter, with long bearings, having the necessary adjustment for wear. Bed has three slides for carriage, affording a solid support to the tool in all positions. The longitudinal, facing and angular feeds have three reversible changes without changing gears; and carriage is provided with a rapid power movement on bed. Tool rest has a compound movement; hand movement of carriage by hand wheel connected with rack bolted to bed. Sliding head is traversed on bed by a pinion connected with feed rack on inner shear, the movement being facilitated by slightly elevating the head on rollers bearing on eccentric studs. Countershafts and wrenches included.

108-INCH LATHE.

Swings 109 inches over bed and 74 inches over carriage, the upper central portion of which can be removed when desired, increasing the swing to 90 inches. Bed can be made of any desired length; when 26 feet the lathe will admit 13 feet 6 inches between centres. Driven by large and wide-faced cone of six changes, back geared and geared into face plate, giving twelve motions to spindle, or double the number by the specially arranged countershaft. Spindles are of large diameter with long bearings, having the necessary adjustment for wear. Bed has three slides for carriage, affording solid support to the tool in all positions. Longitudinal, facing and angular feeds have three reversible changes without changing gears; and carriage is provided with a rapid power movement on bed, there being an extra countershaft for this purpose. Tool rest has a compound movement; hand movement of carriage by hand wheel connected with rack on bed. Sliding head is traversed on bed by pinion connected with feed rack on inner shear, the movement being facilitated by slightly elevating the head on rollers bearing on eccentric studs. Two countershafts and the necessary wrenches included.



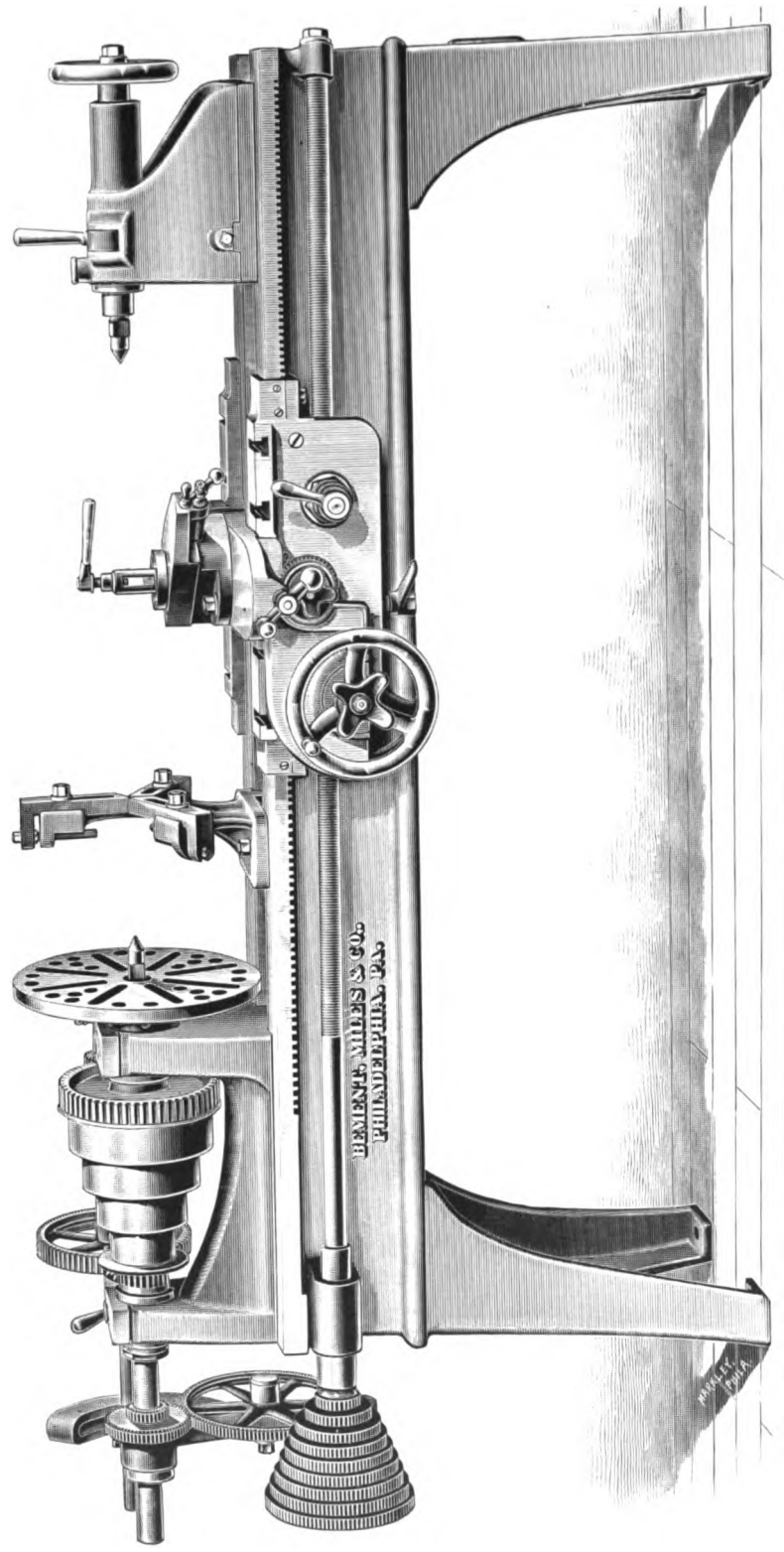
125-INCH CRANK SHAFT LATHE.

120-INCH LATHE.

Swings $121\frac{1}{2}$ inches over bed and 88 inches over carriage, the upper central portion of which can be removed when desired, increasing the swing to 105 inches. Bed can be made of any desired length; when 40 feet long, the lathe will admit 27 feet between centres. Driven by large and wide-faced cone of six changes, back geared and geared into face plate, giving twelve motions to spindle, or double the number by the specially arranged countershaft. Spindles are of large diameter with long bearings, adjustable for wear. Bed has three slides for carriage, affording solid support to the tool in all positions. Longitudinal, facing and angular feeds have three reversible changes without changing gears; and carriage is provided with a rapid power movement on bed, there being an extra countershaft for this purpose. Tool rest has a compound movement; hand movement of carriage by hand wheel connected with rack on bed. Sliding head is traversed on bed by pinion connected with feed rack on inner shear, the movement being facilitated by slightly elevating the head on rollers bearing on eccentric studs. Two countershafts and the necessary wrenches included.

125-INCH CRANK SHAFT LATHE.

For crank shafts, gun forgings, and miscellaneous large work. Swings 125 inches over bed and 108 inches over carriages. Bed can be made of any desired length; when 50 feet long, the lathe will admit 31 feet between centres. Spindles are of large diameter with long bearings, having the necessary adjustment for wear. Driving cone is 50 inches in diameter for $7\frac{1}{2}$ -inch belt having six steps, and giving by means of a shift on the countershaft, twenty-four motions to spindle. Face plate is constructed as a four-jawed chuck, the jaws being removable when required. Sliding head is adjustable along the bed by power from a separate countershaft. The machine is usually constructed with four independent carriages, with bed of sufficient width to insure steadiness in turning the largest diameters. These carriages are entirely independent of each other in all their functions, and have the following motions, viz: Variable, automatic, longitudinal feeds; rapid longitudinal power motion from a separate countershaft; power cross feeds to the main tool post; variable self-acting feeds to the upper tool slides at right angles, as well as hand motions. Both shafts operating the longitudinal feeds and rapid movements have tumbler bearings. All feeds, etc., are effected by the workman from the most convenient position. Includes three countershafts, steady rest, wrenches, etc. With 50 feet bed, this lathe weighs 300,000 pounds.

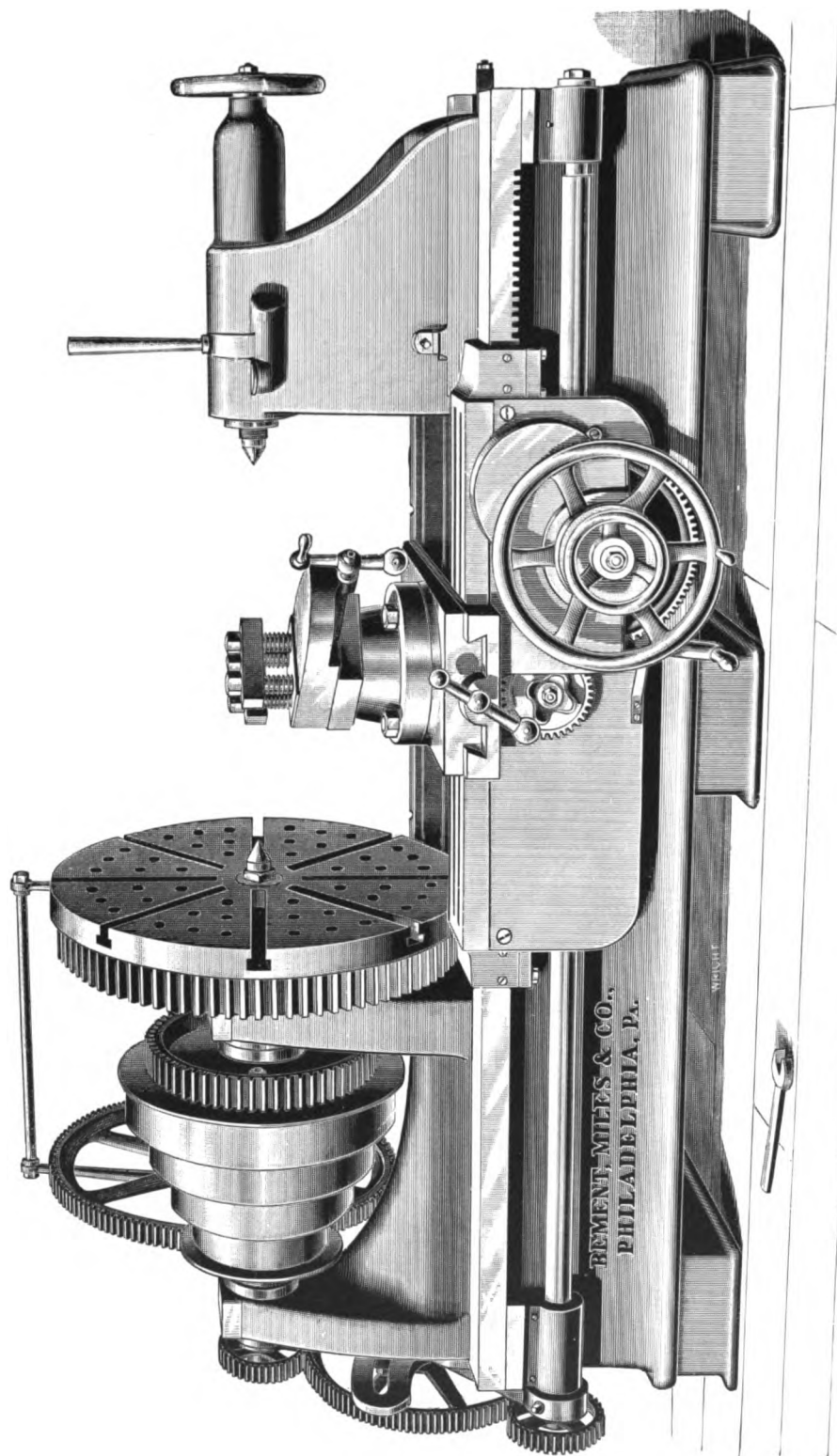


18-INCH PATENT SCREW-CUTTING LATHE.

18-INCH PATENT SCREW-CUTTING LATHE.

WITH A SPECIAL SCREW-CUTTING ARRANGEMENT FOR 16 DIFFERENT THREADS,
WITHOUT CHANGING GEARS.

Swings $18\frac{1}{4}$ inches over bed and $14\frac{1}{4}$ inches over rest carriage. Face plate has eight speeds by cone and back gearing. Spindles are steel of large diameter, supported in long heads having ample bearings of best gun metal with adjustment for wear. Sliding spindle is clamped by concentric conical binder, which takes up the wear and keeps the spindle in a central position. The longitudinal and cross-feed motions are driven by gears and the rack on the bed, giving sixteen changes of feed to each. The operator has only to move the sliding arm to the proper figure on the index stud and tighten the single pinch bolt; the machine will then cut the pitch indicated by the figure. The two sliding pinions serve to double the number of pitches cut by the cone. The main screw is reserved for screw cutting only. Compound rest, steady and follower rests, countershaft and wrenches included. Bed can be made of any desired length.



36-INCH LOCOMOTIVE LATHE, WITH SHORT BED.

20-INCH LATHE, LOCOMOTIVE PATTERN.

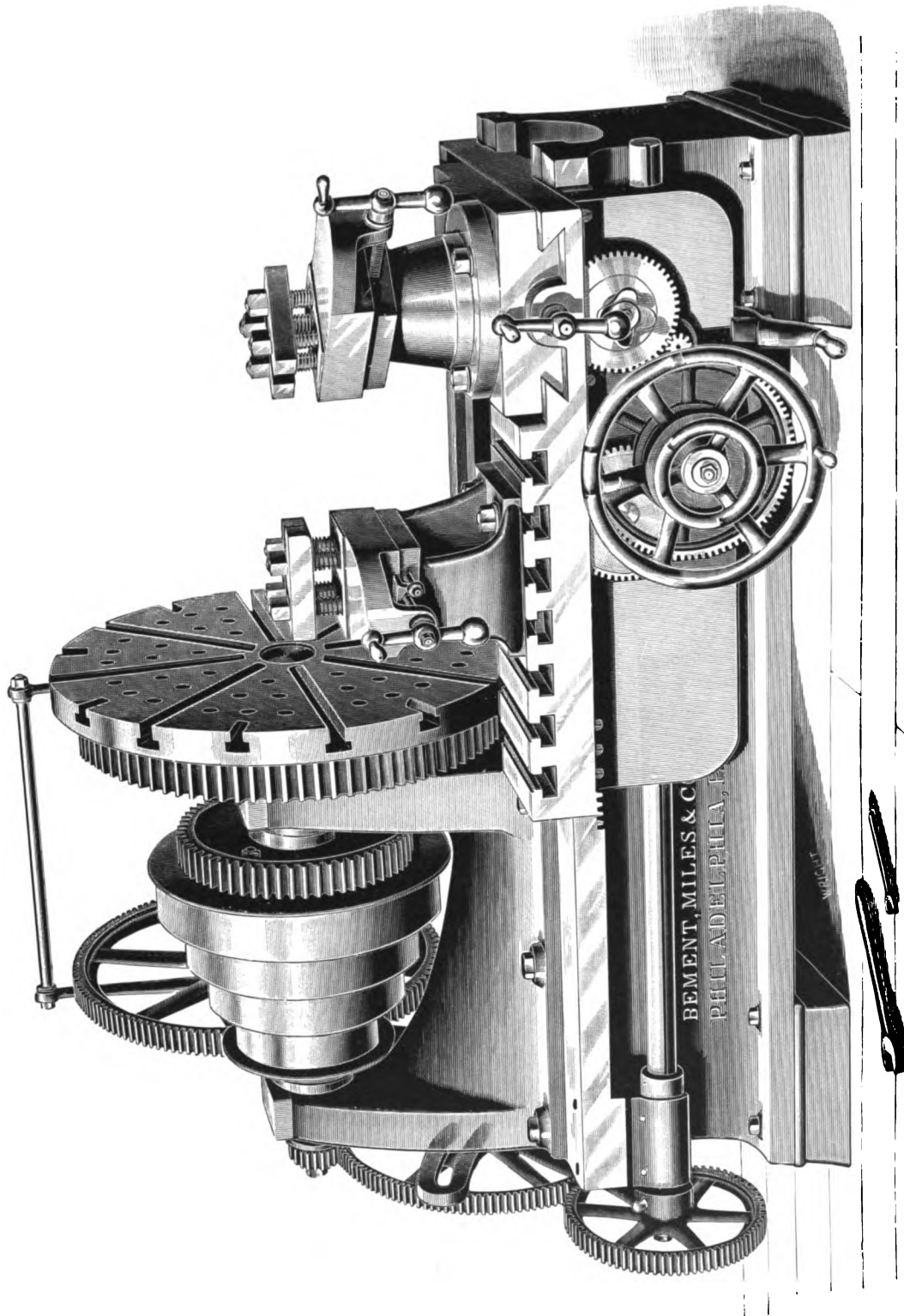
Swings 21 inches over bed and $16\frac{1}{2}$ inches over rest carriage. Bed may be of any required length; when 10 feet long, the lathe will admit 6 feet 3 inches between centres. Cone has four changes, and is back geared, giving eight motions to face plate. Spindles are steel of large diameter, supported in long heads having ample bearings of best gun metal, with adjustment for wear. Sliding spindle is clamped by concentric conical binder, affording a compensation for wear and keeping spindle in a central position.

Carriage has long bearings upon a flat surface on bed. Hand movement of carriage by gearing and rack on bed; power movement in either direction by handle traversing with it. Upper part of sliding head arranged with transverse slide for taper turning. Positive longitudinal and facing feeds giving an infinite gradation from $\frac{1}{100}$ to $\frac{3}{8}$ inch. Independent screw-cutting feeds, separately driven, the thread of lead screw being used only for this purpose. Feeds instantly changed from screw cutting to turning, or vice-versa. Compound slide rest, follower rest, steady rest, screw gearing, countershaft and wrenches included. A special taper attachment may be applied, if desired.

25-INCH LATHE, LOCOMOTIVE PATTERN.

Swings 26 inches over bed and $20\frac{1}{2}$ inches over rest carriage. Bed may be of any required length; when 12 feet long, the lathe will admit 7 feet 5 inches between centres. Cone has four changes, and is back geared, giving eight different speeds. Spindles are steel of large diameter, supported in long heads having ample bearings of best gun metal, with adjustment for wear. Sliding spindle is clamped by concentric conical binder, affording a compensation for wear and keeping spindle in a central position.

Carriage has long bearings upon a flat surface on bed. Hand movement of carriage by gearing and rack on bed; power movement in either direction by handle traversing with it. Upper part of sliding head arranged with transverse slide for taper turning. Positive longitudinal and facing feeds, giving an infinite gradation from $\frac{1}{100}$ to $\frac{1}{4}$ inch. Independent screw-cutting feeds, separately driven, the thread of lead screw being used only for this purpose. Feeds instantly changed from screw cutting to turning, or vice-versa. Compound slide rest, steady rest, follower rest, screw gearing, countershaft and wrenches included. A special taper turning attachment can be applied, if desired.



42-INCH LOCOMOTIVE FACING LATHE.

30-INCH LATHE, LOCOMOTIVE PATTERN.

Swings $30\frac{1}{2}$ inches over bed and $24\frac{1}{2}$ inches over rest carriage. Bed can be made of any desired length; when 12 feet long, the lathe will admit 6 feet 10 inches between centres. Cone has four changes, and is back geared, giving eight different speeds. Spindles are cast steel of large diameter, supported in long heads, having ample bearings of best gun metal, with adjustment for wear. Sliding spindle is clamped by concentric conical binder, affording a compensation for wear and keeping spindle in a central position.

Carriage has long bearings upon a flat surface on bed. Hand movement of carriage by gearing and rack on bed; power movement in either direction by handle traversing with it. Upper part of sliding head arranged with transverse slide for taper turning. Positive longitudinal and facing feeds, giving an infinite gradation from $\frac{1}{100}$ to $\frac{1}{4}$ inch. Independent screw-cutting feeds, separately driven, the thread of lead screw being used only for this purpose. Feeds instantly changed from screw cutting to turning, or vice versa. A special taper-turning attachment may be applied, if desired. Compound slide rest, steady rest, follower rest, screw gearing, countershaft and wrenches included.

36-INCH LATHE, LOCOMOTIVE PATTERN.

Swings $37\frac{1}{2}$ inches over bed and $30\frac{1}{2}$ inches over rest carriage. Bed can be made of any desired length; when 14 feet long, the lathe will admit 7 feet 6 inches between centres. Cone has four changes, is back geared and geared into face plate, giving twelve changes of speed. Spindles are cast steel of large diameter, supported in long heads, having ample bearings of best gun metal, with adjustment for wear. Sliding spindle is clamped by concentric conical binder, affording a compensation for wear and keeping spindles in a central position.

Carriage has long bearings upon a flat surface on bed. Hand movement of carriage by gearing and rack on bed; power movement in either direction by handle traversing with it. Upper part of sliding head arranged with transverse slide for taper turning. Positive longitudinal and facing feeds, giving an infinite gradation from $\frac{1}{100}$ to $\frac{1}{4}$ inch. Independent screw-cutting feeds, separately driven, the thread of lead screw being used only for this purpose. Feeds instantly changed from screw cutting to turning, or vice versa. A special taper-turning attachment may be applied, if desired. Compound slide rest, steady rest, follower rest, screw gearing, countershaft and wrenches included.

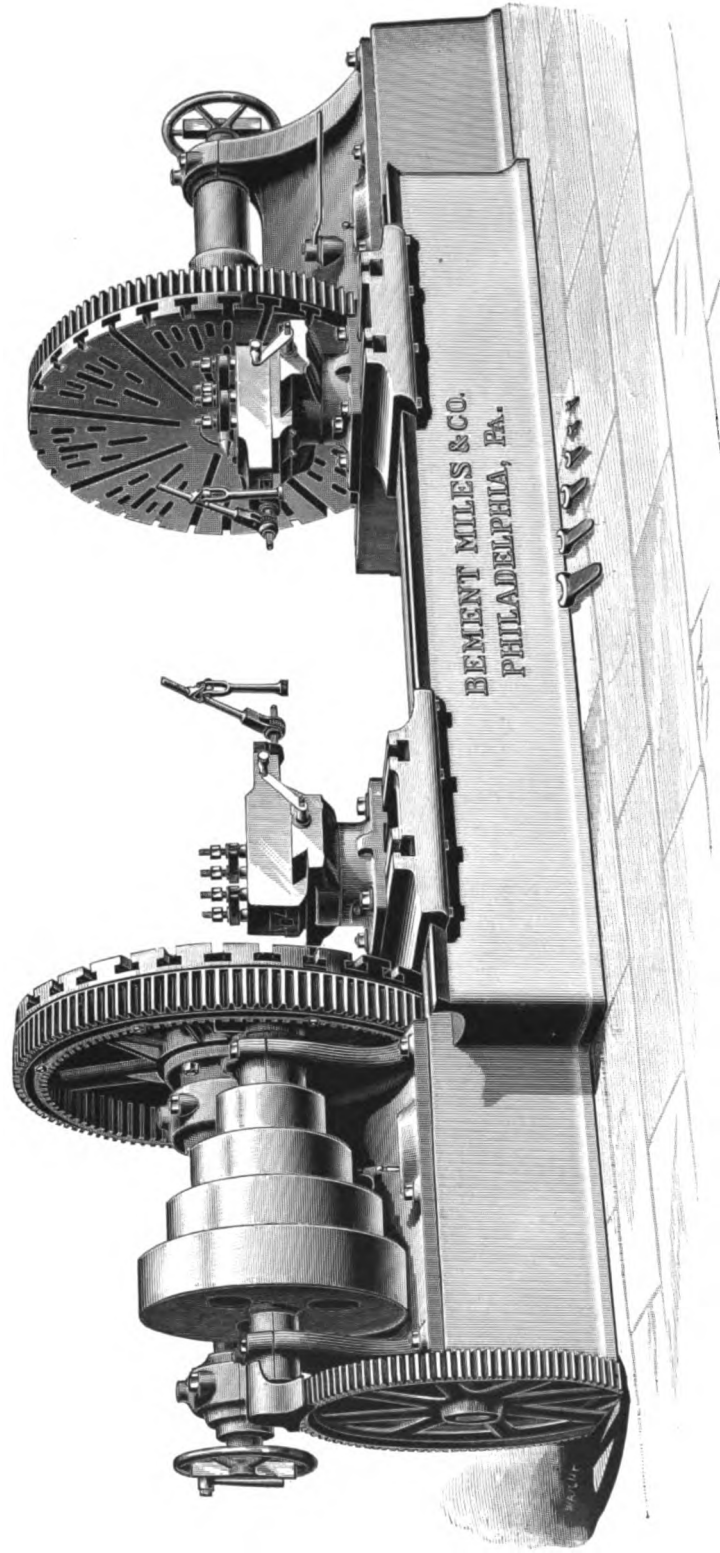
42-INCH LATHE, LOCOMOTIVE PATTERN.

Swings 43 inches over bed and 36 inches over rest carriage. As this lathe is of exactly the same style as the 36-inch, it requires no special description. The illustration represents it as a facing lathe only, the bed being shortened and an extra tool rest provided, which can be shifted to any required part of the carriage. When built as a complete lathe, it is similar to the 36-inch in its arrangement.

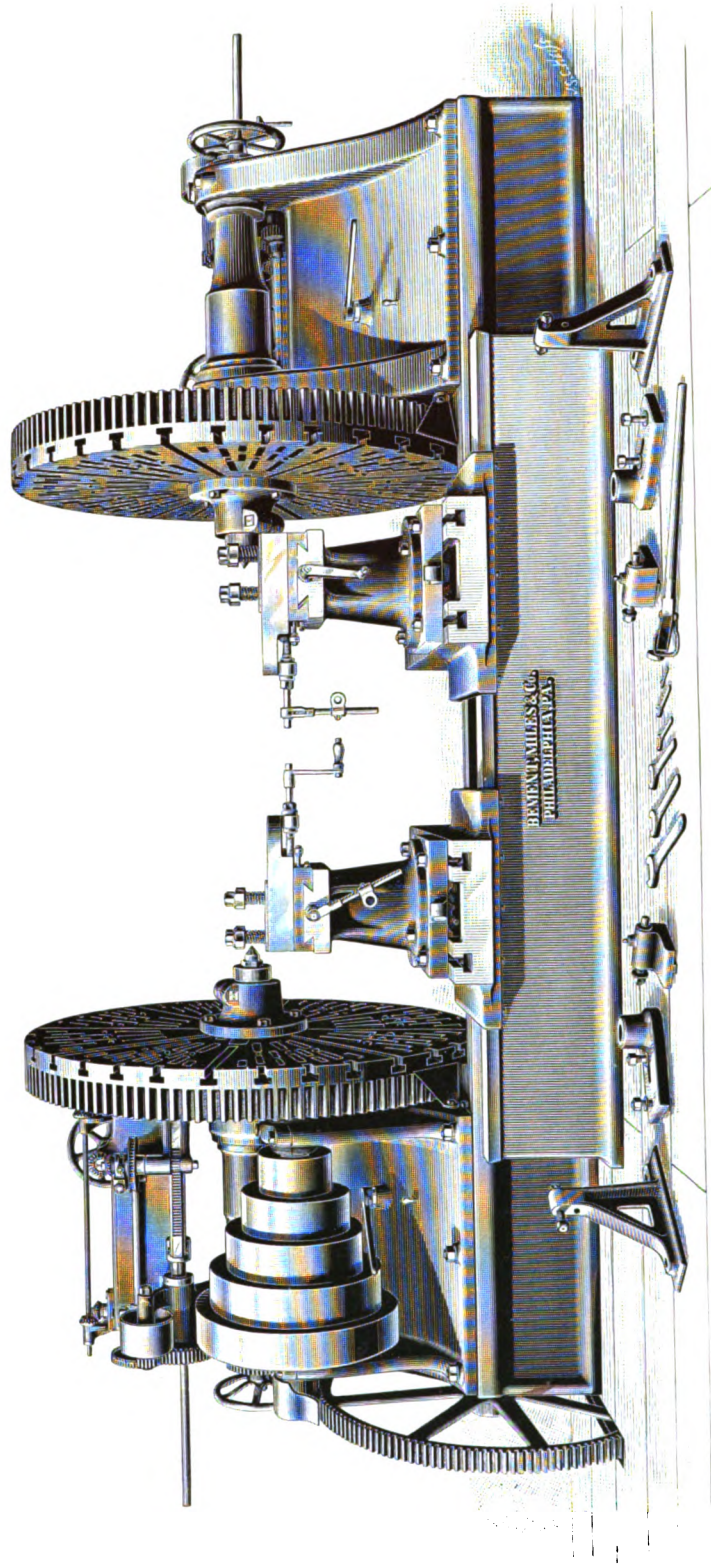
LATHE FOR TURNING AND BORING 8-INCH STEEL GUNS.

Swings 56 inches in diameter. Driven by a 30-inch cone for 6-inch belt and geared three times to face plate, giving sixteen changes of speed. Spindles are of best forged steel of large diameter having long bearings with adjustment for wear. All the driving pinions, as well as the gear ring of face plate, are made of steel. Bed has three slides, affording solid support to the carriages and so arranged as to permit them to pass the steady rest. Two carriages are provided, each having two tool slides, with automatic feeds in all directions; each carriage is independent of the other and both have rapid power motions along the bed in either direction. A separate screw is used for screw cutting. The taper attachments operate at any desired angle through a distance of seven feet without shifting. For boring, a hollow bar six inches in diameter is furnished when ordered. This is supported in movable bearings at proper intervals upon a suitable boring bench, and has the necessary automatic feeds for boring as well as screw cutting, with rapid return movement in either direction. This boring bench is adjusted along its bed by rack and gearing. Countershaft and wrenches included.

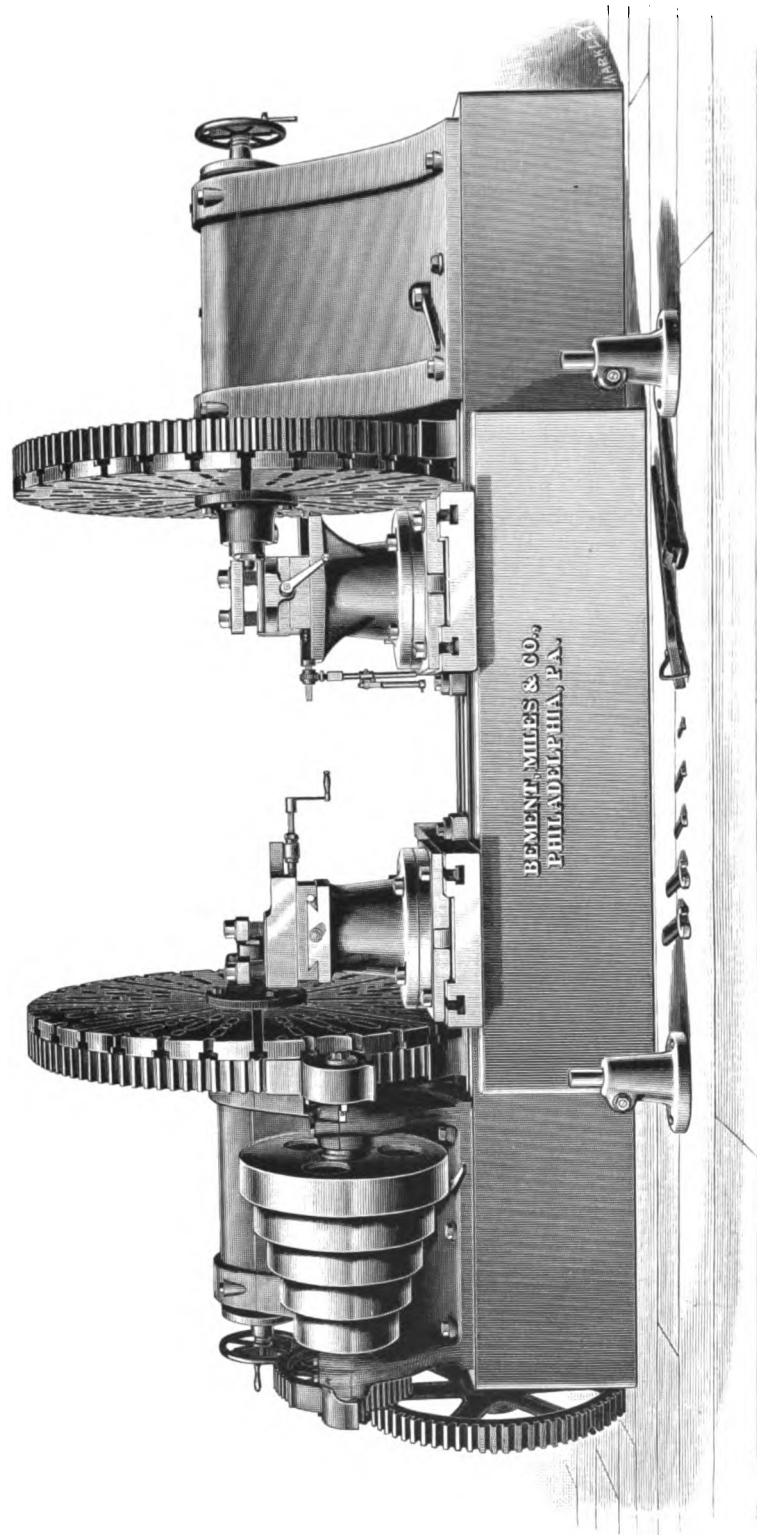
In addition to the above we have built boring and turning lathes for guns up to fourteen inches bore, and are prepared to furnish still larger ones. We also build special lathes for boring and turning hoops and jackets of guns of any size. Specifications in detail will be furnished when desired.



57-INCH DOUBLE DRIVING WHEEL LATHE.



84-INCH DOUBLE DRIVING WHEEL LATHE, WITH DOUBLE QUARTERING ATTACHMENT.



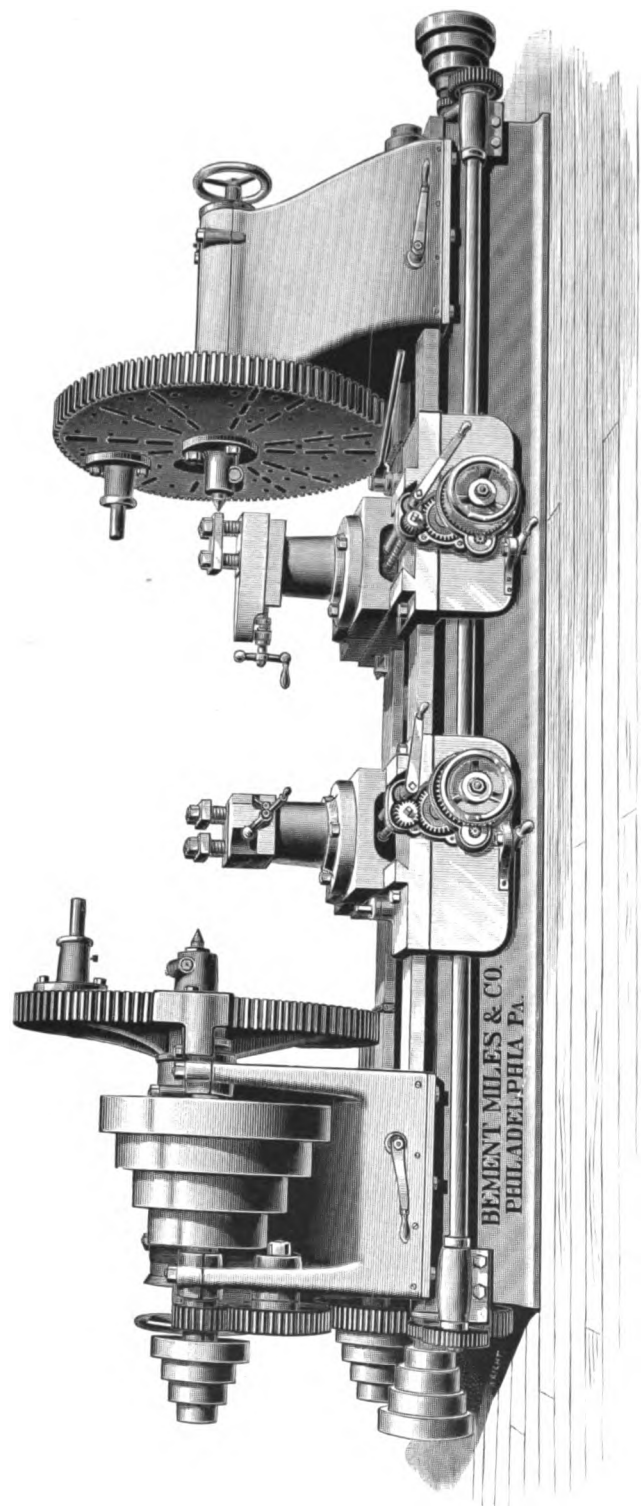
90-INCH DOUBLE DRIVING WHEEL LATHE.

Double Locomotive Driving Wheel Lathes, with Overhead Feed for Tool-posts.

51-INCH DOUBLE WHEEL LATHE.

Swings 51 inches in diameter. Driving cone is so geared as to give eight changes of speed to one face plate and four to the other. Face plates can be driven together, or separately, and at the same or different speeds, as desired. Feeds variable and self-acting at all angles by overhead rock shaft, operated by slotted cranks at end of spindles. Each main spindle has an internal sliding spindle, with sufficient movement beyond face plates to swing driving wheels on axles when crank pins are in place. Centre line of spindles is carried backward so as to bring the cutting strains on greatest diameters within the area of bed, by which means the front slides are elevated to correspond with curvature face plates, increasing the strength of bed where subject to the greatest strains, also shortening and consequently stiffening the tool rests. Quartering attachment, single or double, furnished when required. Countershaft and wrenches included.

In addition to the 51-inch machine, we build the following sizes, viz : 57-inch, 69-inch, 79-inch, 84-inch and 90-inch. The description given for the smallest size applies to all the others, with the single exception that the 79, 84 and 90-inch have 10 speeds instead of 8. When required, any of the lathes will be provided with a single or double wheel quartering and crank pin boring attachment. When a single attachment is used, it is applied to a vertical surface on the back of the movable head, a position very convenient for the workman. The second portion of the apparatus constituting the double attachment, is applied to the back of the cone head, and the boring bar is immediately over the main spindle. With this arrangement are included the necessary parts to clamp the face plates in the desired position for quartering. The apparatus is provided with power feeds, and rapid hand movement to the boring bars, and it may be ordered either for right or left-hand quartering.



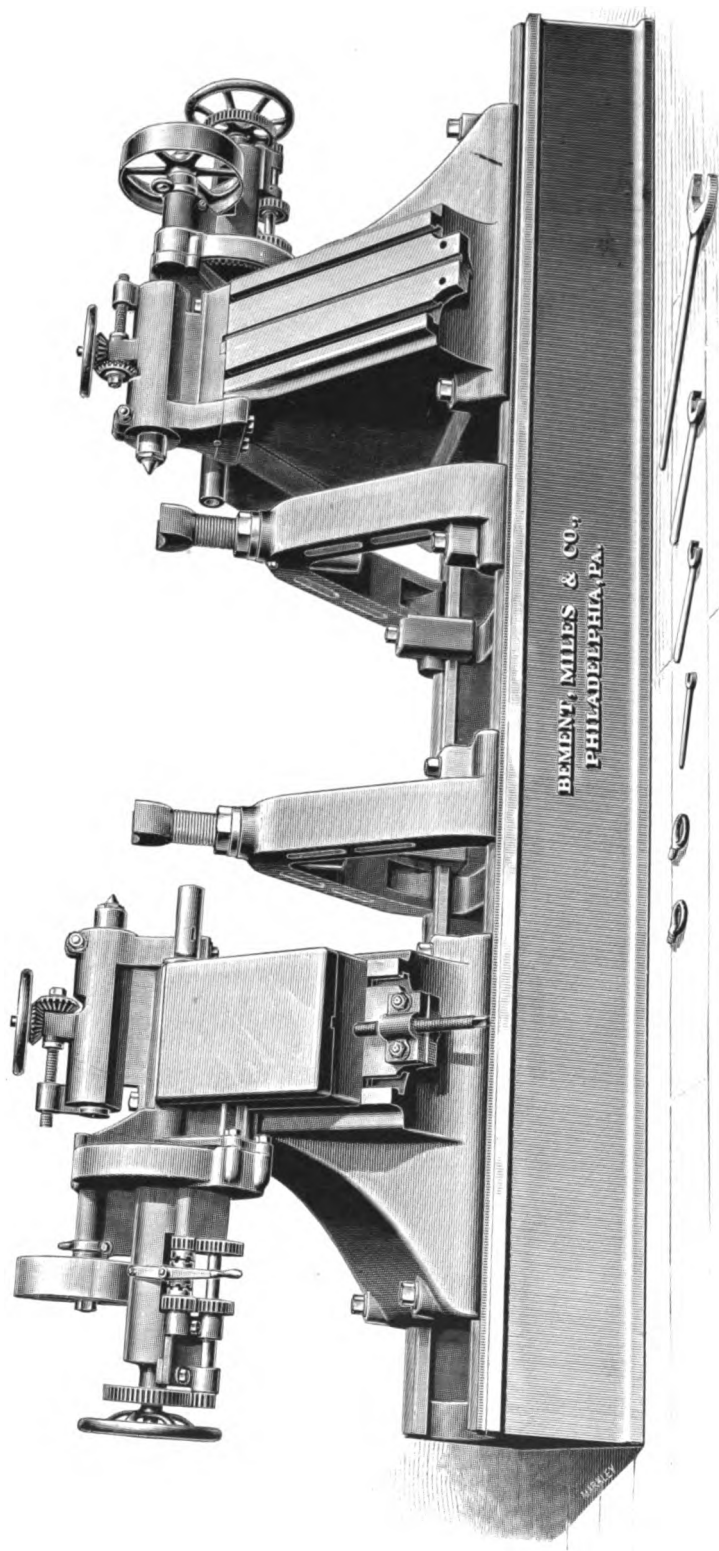
54-INCH DOUBLE DRIVING WHEEL LATHE, WITH CARRIAGE FEED.

Double Locomotive Driving Wheel Lathes with Carriage Feed.

These lathes are built of the following sizes, viz: 42-inch, 54-inch, 61-inch, and 66-inch. The heads and general arrangements for driving are in the main similar to those of the lathes previously described, the important difference being in the construction of the carriages, which are fed from below, somewhat after the manner of an ordinary standard lathe. The following description of the 66-inch size will answer for all the others, as they are similar in general arrangement and details.

Swings 66 inches in diameter. Driving cone is geared to give eight changes of speed to one face plate and four to the other. Face plates can be driven together at the same speed when turning wheels on their axle, or separately at different speeds when boring on one face plate and turning on the other. Feeds variable and self-acting at all angles by gearing within the carriage. Each main spindle has an internal sliding spindle with a conical binder to take up the wear. Centre line of spindles is carried backward so that the tool rest will be firmly supported in turning the largest diameters. A quartering attachment, single or double, is applied when required. Countershaft and wrenches included.

With these machines we also furnish, when required, the same wheel quartering and crank pin boring attachments, single or double, that are applied to the preceding lathes.

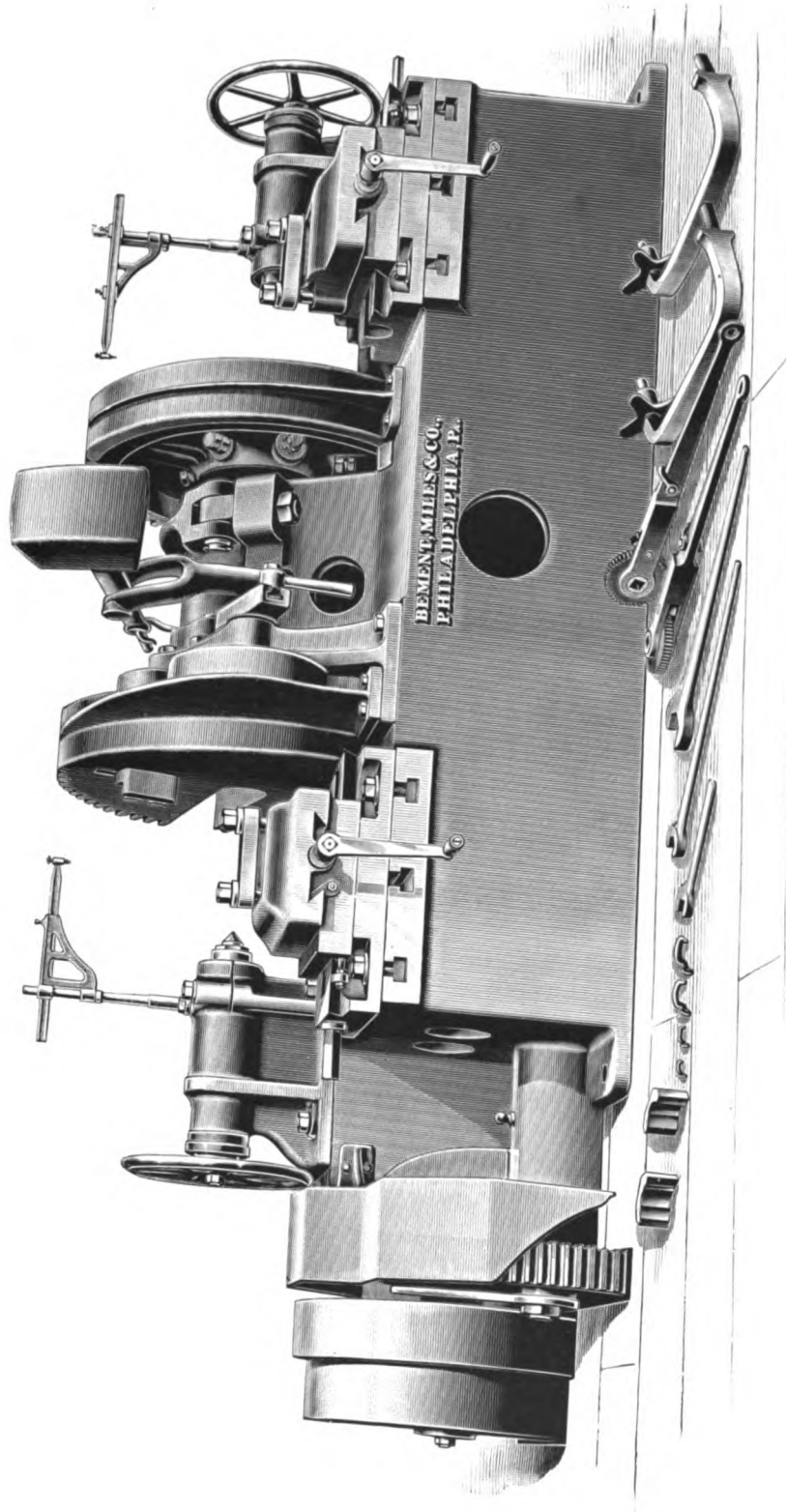


RIGHT AND LEFT-HAND WHEEL QUARTERING MACHINE.

RIGHT AND LEFT-HAND WHEEL QUARTERING MACHINE.

For quartering and boring crank pin holes in locomotive driving wheels. Swings 85 inches in diameter, and is adapted to any width of gauge, and any length of stroke from 12 inches to 30 inches; or, if necessary, it can be arranged for a 10-inch stroke by reducing the diameter of the spindles and boring bars. Boring spindles have two rates of speed, 15 inches traverse, two automatic feeds, and rapid hand movement. The necessary change, for right or left-hand quartering, is effected by swinging the saddle over to the other side of the head. Axle is held on centres, also on adjustable V-bearings supported by framing, to which the wheels are firmly clamped. If desired, a pair of rests may be attached to boring bars for turning crank pins. Countershaft and wrenches included.

We also build a 90-inch quartering machine similar to the above.

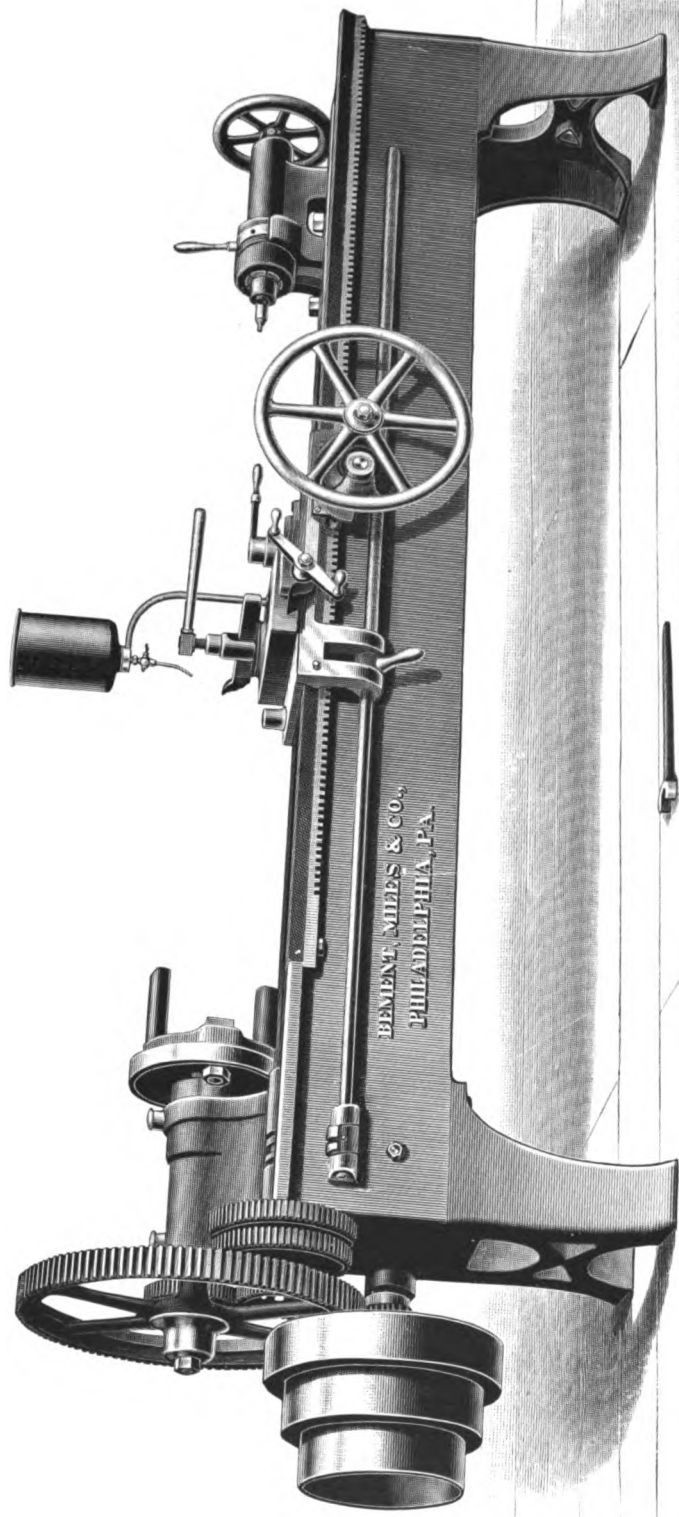


46-INCH DOUBLE CAR-WHEEL LATHE.

46-INCH DOUBLE CAR-WHEEL LATHE.

For turning steel-tired wheels up to 42 inches diameter on their axles and truing the journals when worn. Driven by cone of two changes and powerfully geared to enable the turning to be done without chattering by one broad tool covering the entire width of the wheel. Each of the connected face plates is geared into two pinions, so that the driving may be continuous without filling in the gap. The hinged and counterweighted cap opens and shuts with great facility and without the use of any filling-in piece. Front of bed is elevated and tool rests shortened to add to their stiffness. Hub of each face plate is provided with three large set screws for clamping the axles close to the wheels; each wheel is fastened in three places to its face plate and the ends of the axle are held in centres, affording in all fourteen points of support and insuring great steadiness under the heavy cuts. Tool slides have variable longitudinal feeds, automatic or by hand. The speeds required for journal turning are obtained by disengaging the back bearing. Countershaft and wrenches included. Turning tools, calipers and skids for rolling wheels into position furnished when required.

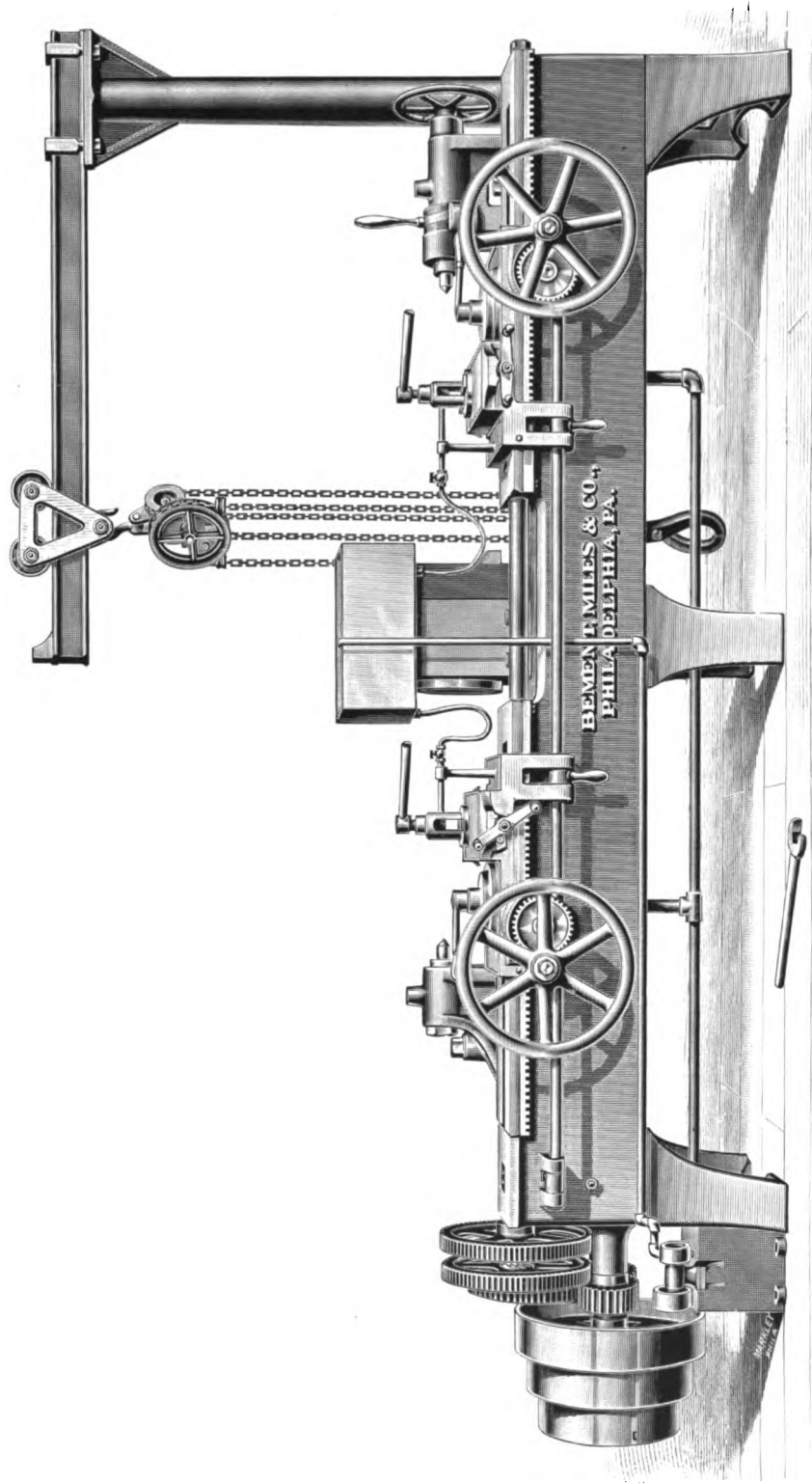
In addition to the above lathe, we build another of exactly the same arrangement to swing 36 inches, intended mainly for narrow-gauge wheels.



SINGLE AXLE LATHE.

SINGLE AXLE LATHE.

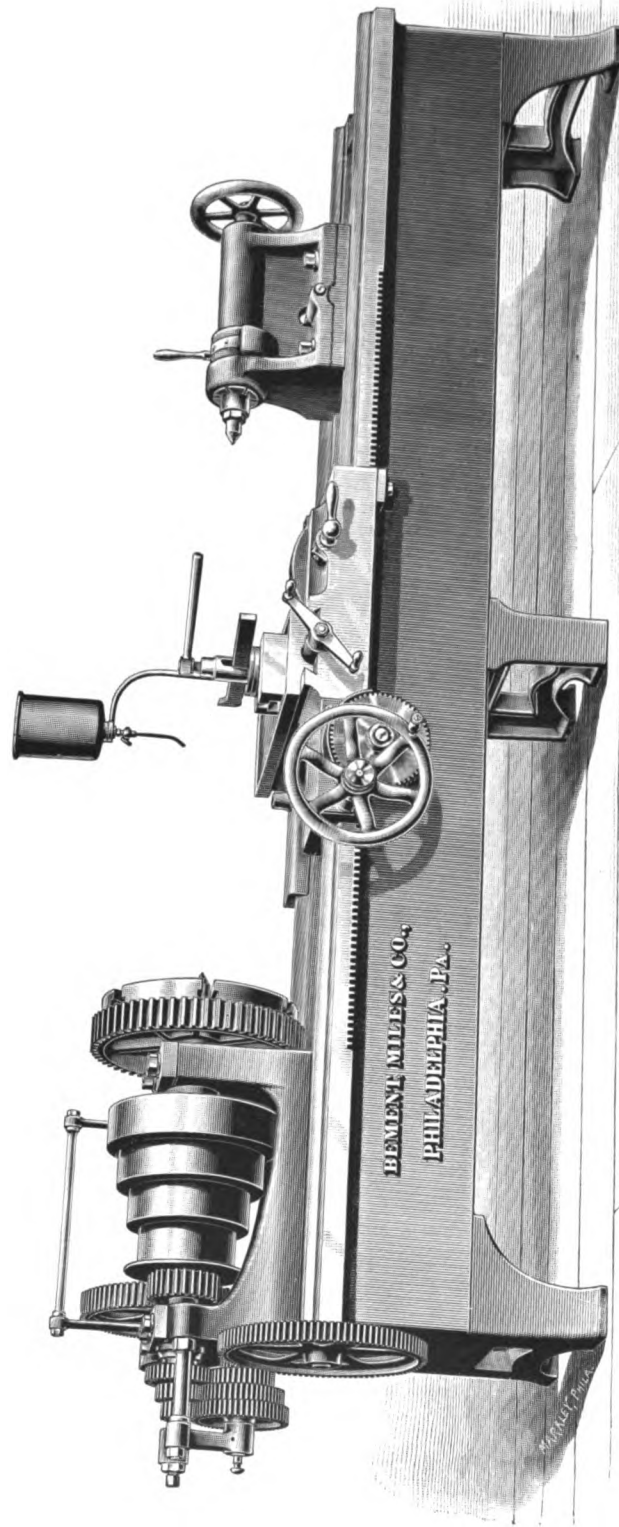
For turning car and locomotive truck axles. Driven by cone of three changes, which, with two pairs of tight and loose pulleys on countershaft, gives six motions to spindle. Two feeds, for roughing and finishing, positive and self-acting by steel screw placed as near the line of cut as possible. The changes from roughing to finishing, both in speed and feed, are made by the workman instantly and without moving from his place. Driver on spindle is double and self-adjusting. The dead spindle is clamped by an improved conical binder, which is self-adjusting and self-centring. Hand movement of rest carriage by hand wheel and gearing, connected with steel rack on bed. Spindles are carried backward and front portion of bed raised, by which means the slides are protected from chips and water, the bed strengthened, the tool rests shortened and stiffened and the carriages allowed to pass the sliding heads for convenience in changing axles. An automatic pump, with reservoir and piping, supplies the necessary lubricant to the carriage. The tool holder is adjustable. When so ordered, the lathe will be provided with a crane for handling the axles. Countershaft and wrenches included.



DOUBLE AXLE LATHE.

DOUBLE AXLE LATHE.

For turning car and locomotive axles. Driven by cone of three changes, which with two pairs of tight and loose pulleys on countershaft, gives six motions to spindle. Two feeds, for roughing and finishing, positive and self-acting by steel screw placed as near the line of cut as possible. The changes from roughing to finishing, both in speed and feed, are made by the workman instantly and without moving from his place. Driver is double and self-adjusting. The sliding head spindle is clamped by an improved conical binder which is self-adjusting and self-centring. Hand movement of rest carriages by hand wheel and gearing connected with steel rack on bed. Spindles are carried backward and front portion of bed raised, by which means the slides are protected from chips and water, the bed strengthened, the tool rests shortened and stiffened, and the carriages allowed to pass sliding heads for convenience in changing axles. An automatic pump, with reservoir and piping, supplies the necessary lubricant to each carriage. Tool holders are adjustable. Crane for holding the axle, countershaft and wrenches included.



LOCOMOTIVE DRIVING AXLE LATHE.

LOCOMOTIVE AND CAR AXLE LATHE.

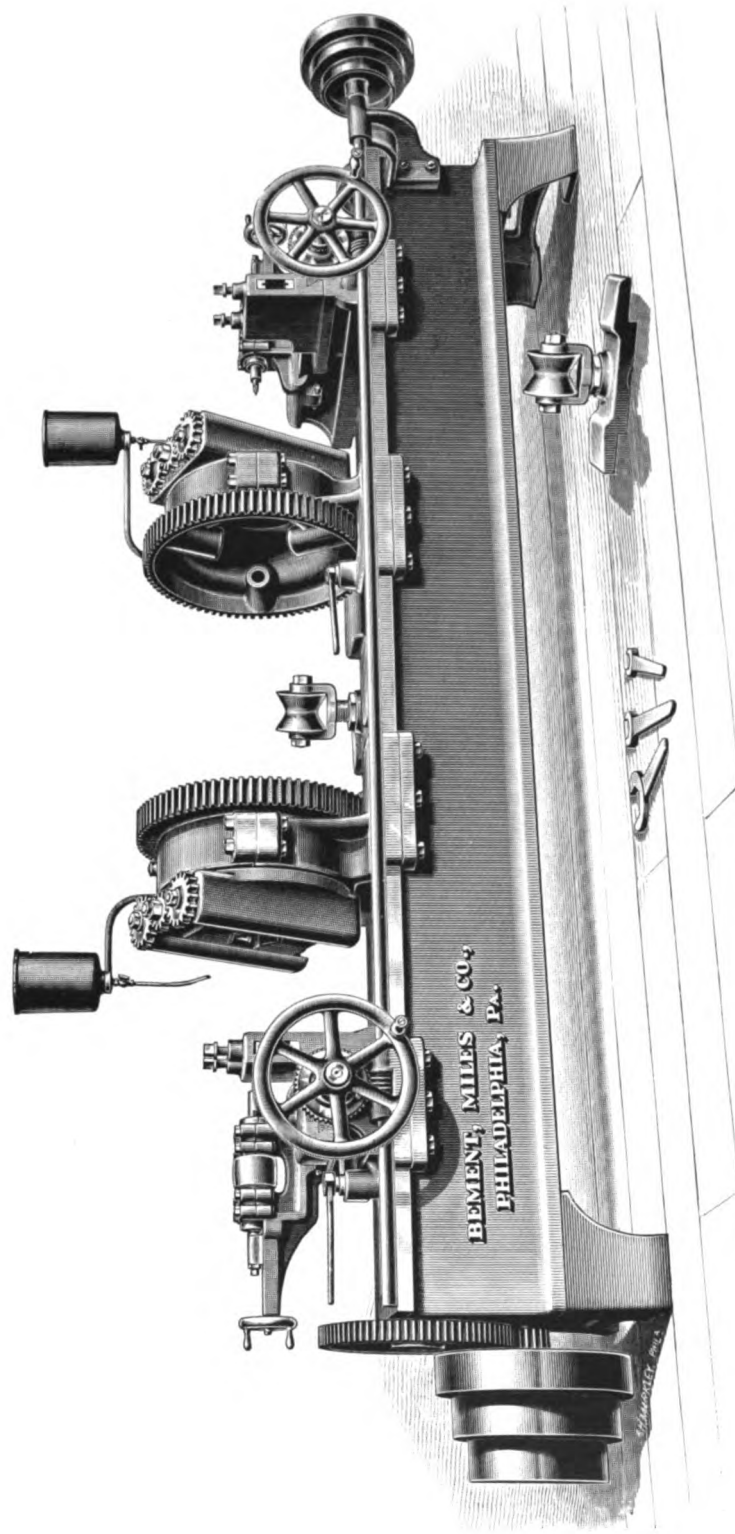
For turning all kinds of railroad axles. Has six changes of speed by large cone and powerful gearing, and three positive self-acting feeds quickly changeable from one to another. Driver on spindle is double and self-adjusting. Dead spindle is clamped by an improved conical binder to take up the wear and keep it central. Hand movement of rest carriage by hand wheel, rack and gearing. When required, an automatic pump with tank and piping for supplying lubricant to the tool will be provided. Swivel rest, adjustable tool holder, countershaft with two sets of pulleys for doubling the speeds, etc., included.

LATHE FOR LOCOMOTIVE DRIVING AXLES.

Driven by cone of four changes, back geared directly to face plate, giving eight motions to spindle. Feed self-acting, with three changes, by cone gearing, etc., connected with steel screw placed between the two forward shears of the triple bed. Dead spindle clamped by an improved conical binder, which is self-centring and self-adjusting. Hand movement of carriage by hand wheel and gearing connected with steel rack on bed. When required, an automatic pump, with reservoir and piping for supplying lubricant to the carriage, will be provided. The lathe may also be ordered with a crane for handling the axles. Countershaft and wrenches included.

SINGLE AXLE LATHE, WITH TWO CARRIAGES.

Intended for turning railroad axles, but especially the curved portion between the wheel seats, using for this purpose a former, with hardened steel surfaces, which guides the tool slides in their movement. When it is desired to use the machine for turning the ends of axles, the slides may be quickly disconnected from the former and operated in the usual way. The power and strength of the driving gear are increased to withstand the two cuts; but, otherwise, the construction of the machine is the same as that of our regular axle lathe. Prices include the former, a countershaft and the necessary wrenches.



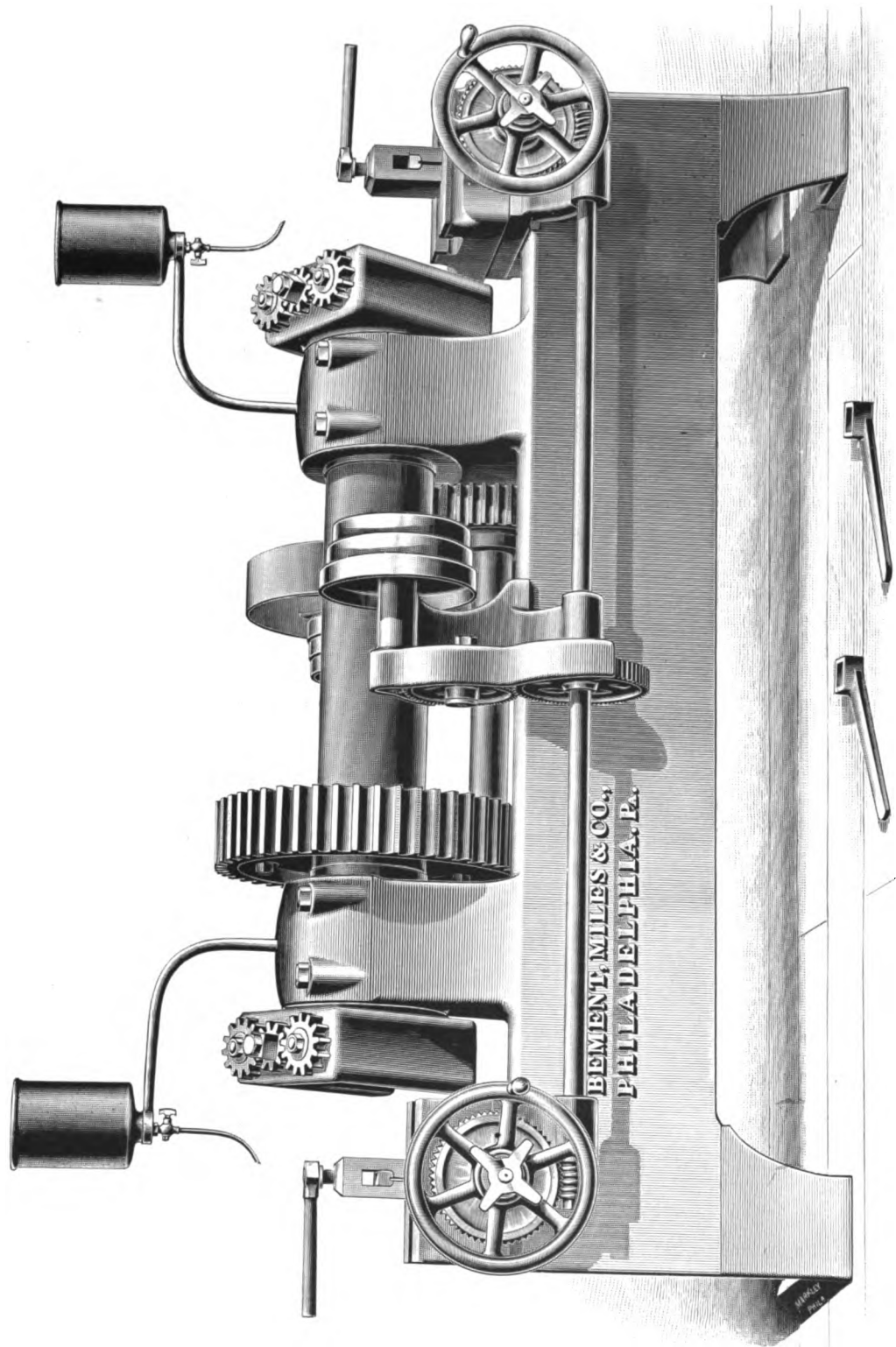
No. 2 DOUBLE CUTTING-OFF AND CENTRING MACHINE.

No. 1 DOUBLE CUTTING-OFF AND CENTRING MACHINE.

For railroad axles and shafts of any diameter not exceeding $7\frac{1}{2}$ inches. Axles revolve in self-centring steel faced jaws, adjustable by rack and pinion to any position on bed; and are driven by cone and double gearing, giving three changes of speed, any of which may be instantly accelerated as the cutting tools approach the centre of the axle, the number of speeds being thereby increased to six. Tool slides may be adjusted by rack and pinion to any length of axle, and feed together, or separately, each having three changes by power, with rapid hand movement, the change from self-feed to hand motion being effected at once. Centring heads with revolving spindles, driven by a separate countershaft, slide on tool carriages to and from their drilling position by means of a convenient lever. Unless otherwise ordered, an automatic pump, with tank and piping, will be provided for lubricating the tools. Countershafts, adjustable rollers to facilitate the handling of the work, and wrenches included. Can be furnished either with or without the centring attachments.

No. 2 DOUBLE CUTTING-OFF AND CENTRING MACHINE.

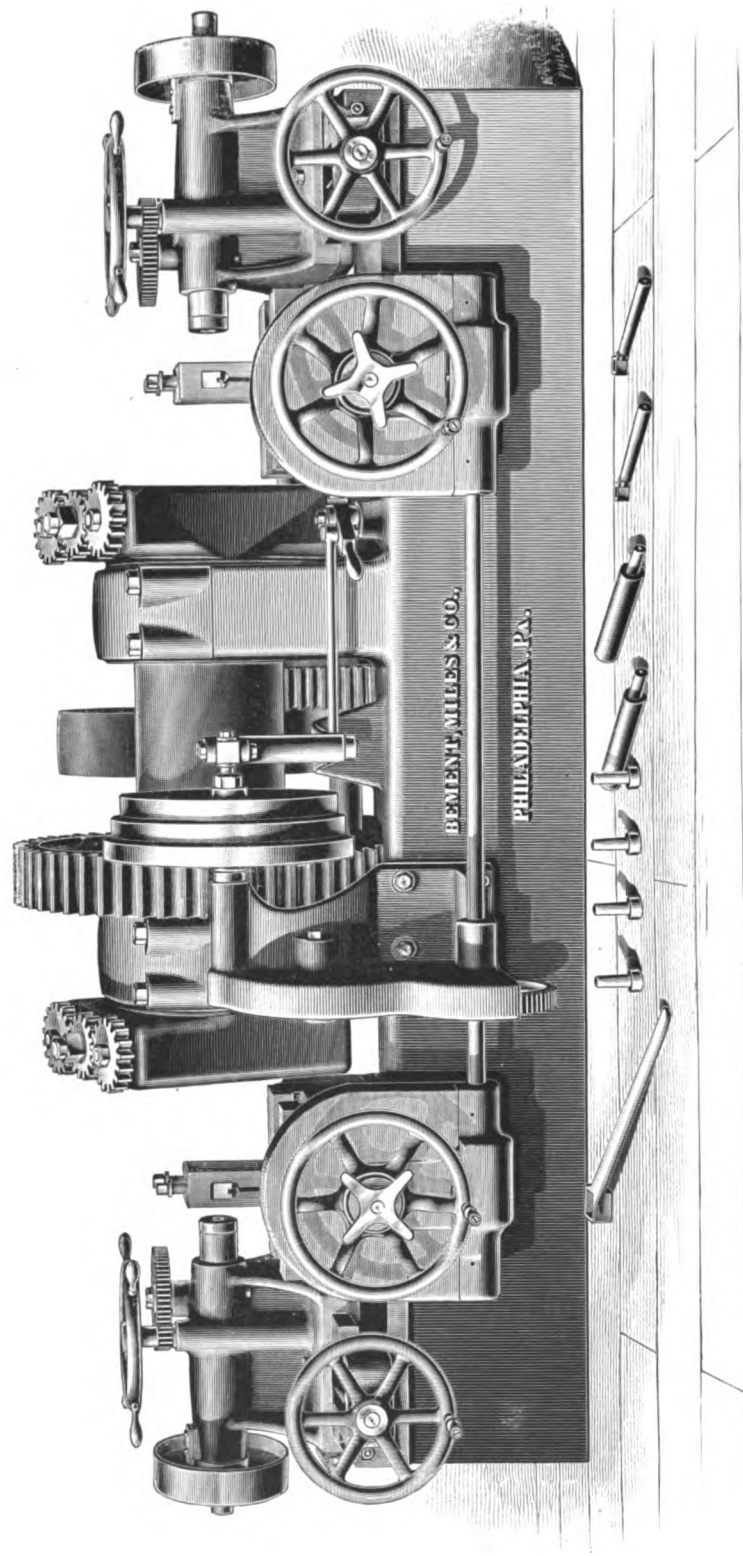
For railroad axles and shafts of any diameter not exceeding 9 inches. Axles revolve in self-centring steel faced jaws, adjustable by rack and pinion to any position on bed; and are driven by cone and double gearing, giving three changes of speed, any of which may be instantly accelerated as the cutting tools approach the centre of the axle, the number of speeds being thereby increased to six. Tool slides may be adjusted by rack and pinion to any length of axle, and feed together, or separately, each having three changes by power, with rapid hand movement, the change from self-feed to hand motion being effected at once. Centring heads with revolving spindles, driven by a separate countershaft, slide on tool carriages to and from their drilling position by means of a convenient lever. Unless otherwise ordered, an automatic pump with tank and piping, will be provided for lubricating the tools. Countershafts, adjustable rollers to facilitate the handling of the work, and wrenches included. Can be furnished either with or without the centring attachments.



No. 3 DOUBLE CUTTING-OFF MACHINE, WITHOUT CENTRING ATTACHMENTS.

No. 3 DOUBLE CUTTING-OFF AND CENTRING MACHINE.

For railroad axles and shafts of any diameter not exceeding $5\frac{1}{2}$ inches. Axles revolve in self-centring jaws of hardened steel, driven by spur gearing through a barrel bored out 6 inches. Tool slides are in fixed positions, but made very broad, thus allowing an adjustment of tool posts to suit different lengths of axles. Tool slides feed together, or separately, each having three changes by power, with rapid hand movement, the change from self-feed to hand motion being effected at once. Unless otherwise ordered, an automatic pump, with tank and piping, will be provided for lubricating the tools. Countershaft and wrenches included. Can be furnished either with, or without, centring attachments.



No. 4 DOUBLE CUTTING-OFF AND CENTRING MACHINE.

No. 4 DOUBLE CUTTING-OFF AND CENTRING MACHINE.

For railroad axles and shafts not exceeding 10 inches in diameter. Axles revolve in self-centring jaws of hardened steel, driven by spur gearing through a barrel bored out eleven inches. Tool slides are fixed in position, but have a longitudinal adjustment of tool-posts for different lengths of axles. Two driving speeds are provided, also three feeds to each carriage, which may be operated together or separately. Unless otherwise ordered, an automatic pump with tank and piping will be provided for lubricating the tools. Centring attachments added if required. Countershafts and wrenches included.



DOUBLE AXLE CENTRING MACHINE.

DOUBLE AXLE CENTRING MACHINE.

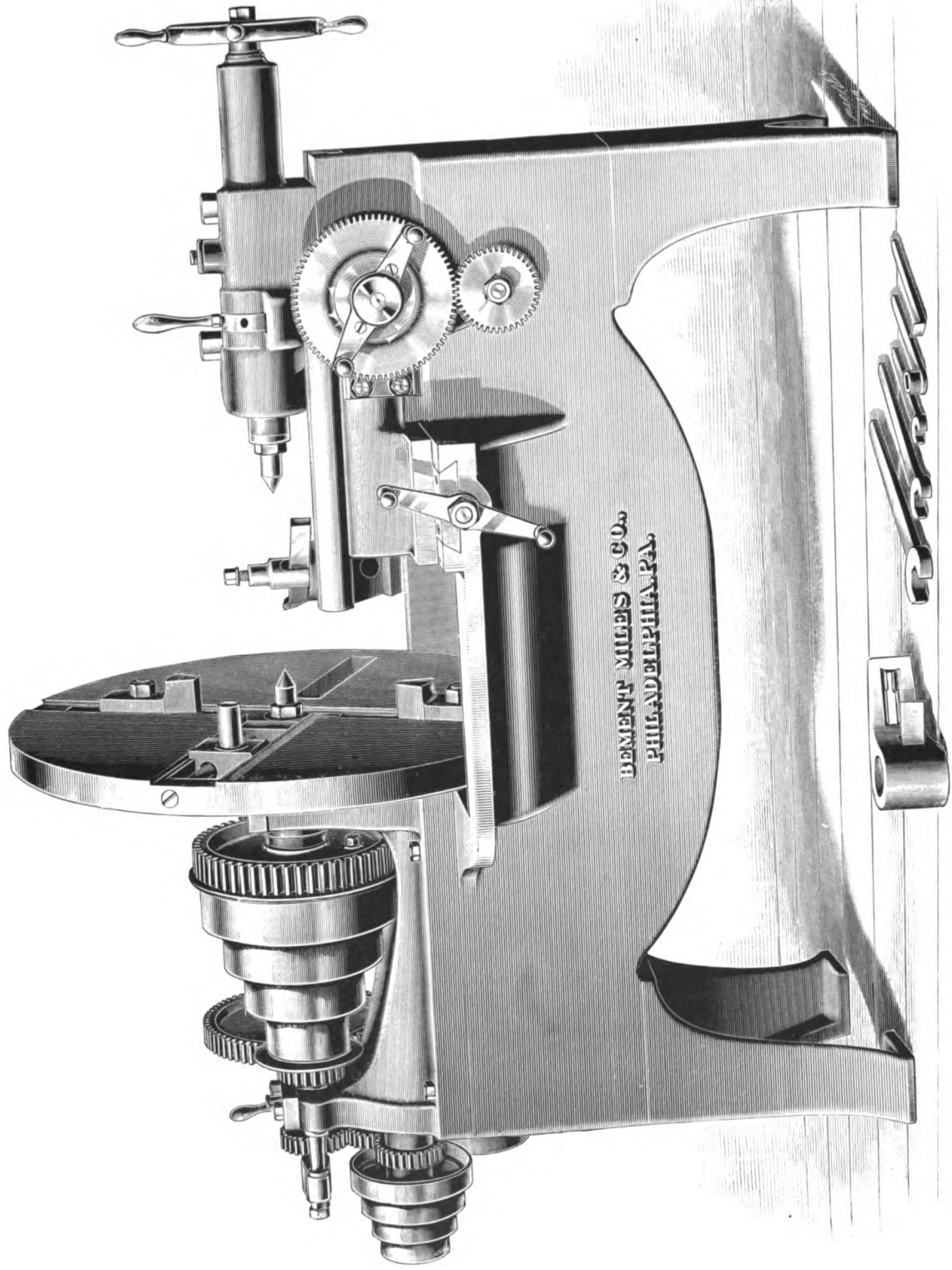
Will centre both ends of a car or locomotive axle at the same time. Spindles are of steel and fed to work by large hand-wheel, geared to spindle, and placed in convenient position for operating. The two chucks are fitted with adjustable rollers, by means of which they may be accurately and quickly centred. Countershaft, etc., included.

SHAFT-STRAIGHTENING MACHINE.

For straightening or bending rails, bars and shafts without heating, up to round bars 6 inches in diameter.

Screw housing is movable the whole length of bed on friction rolls, by hand wheel, rack and pinion; and can, if desired, be readily removed from bed.

Both centres run in and out by screw and hand wheel; they are movable to any position on bed, and swing vertically on pivots to raise and lower the work.

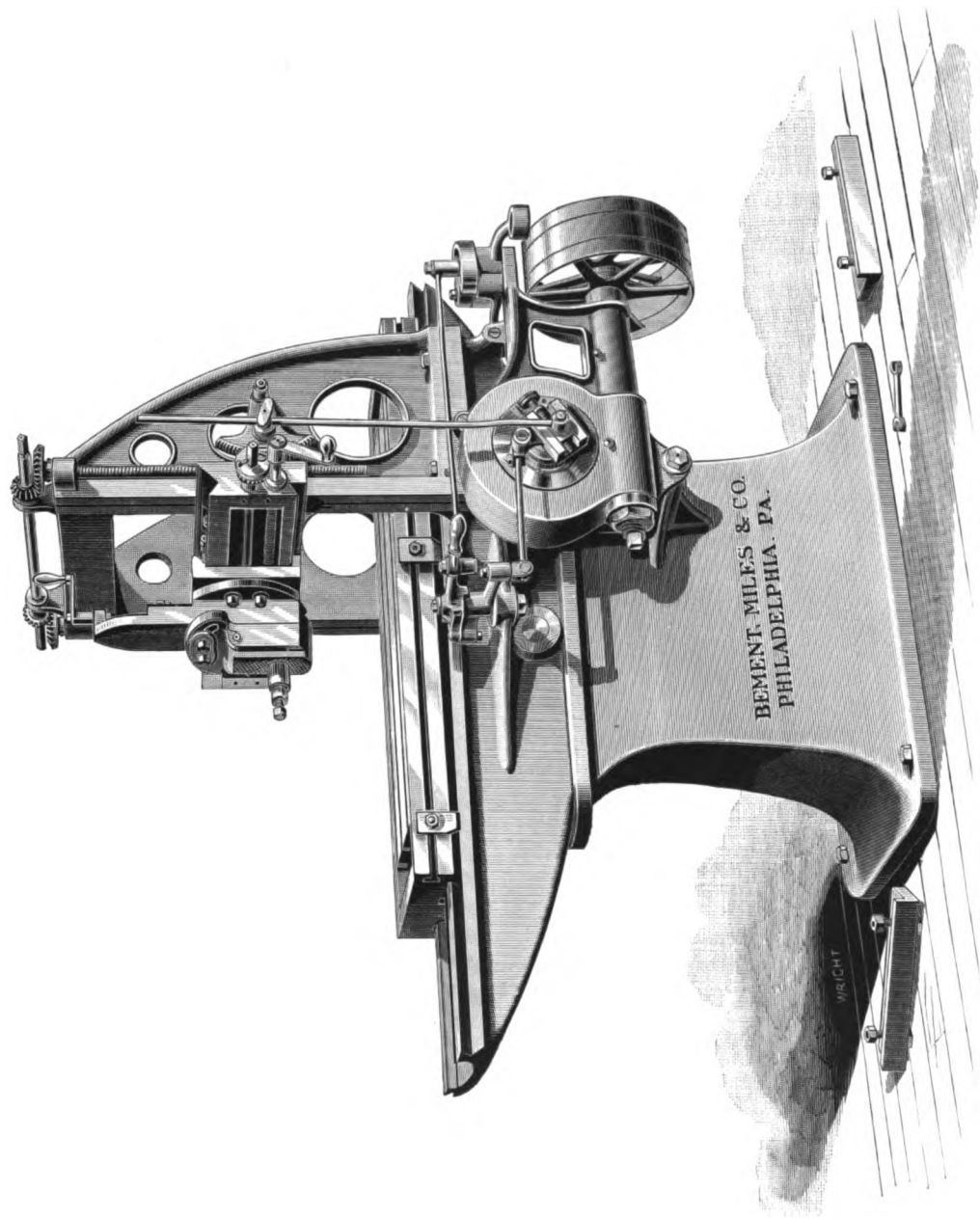


LINK HANGER LATHE.

LINK HANGER LATHE.

Mainly for drilling and turning the hubs of locomotive link hangers. Swings 36 inches. Driven by cone and back gearing, giving eight motions to face plate, which is arranged as a four-jawed chuck for convenience of holding the work. Sliding spindle is clamped by a concentric conical binder; carriage has four feeds, and rapid hand movement. Includes a drill holder, countershaft and wrenches.

Planing, Shaping and Slotting
... Machines ...



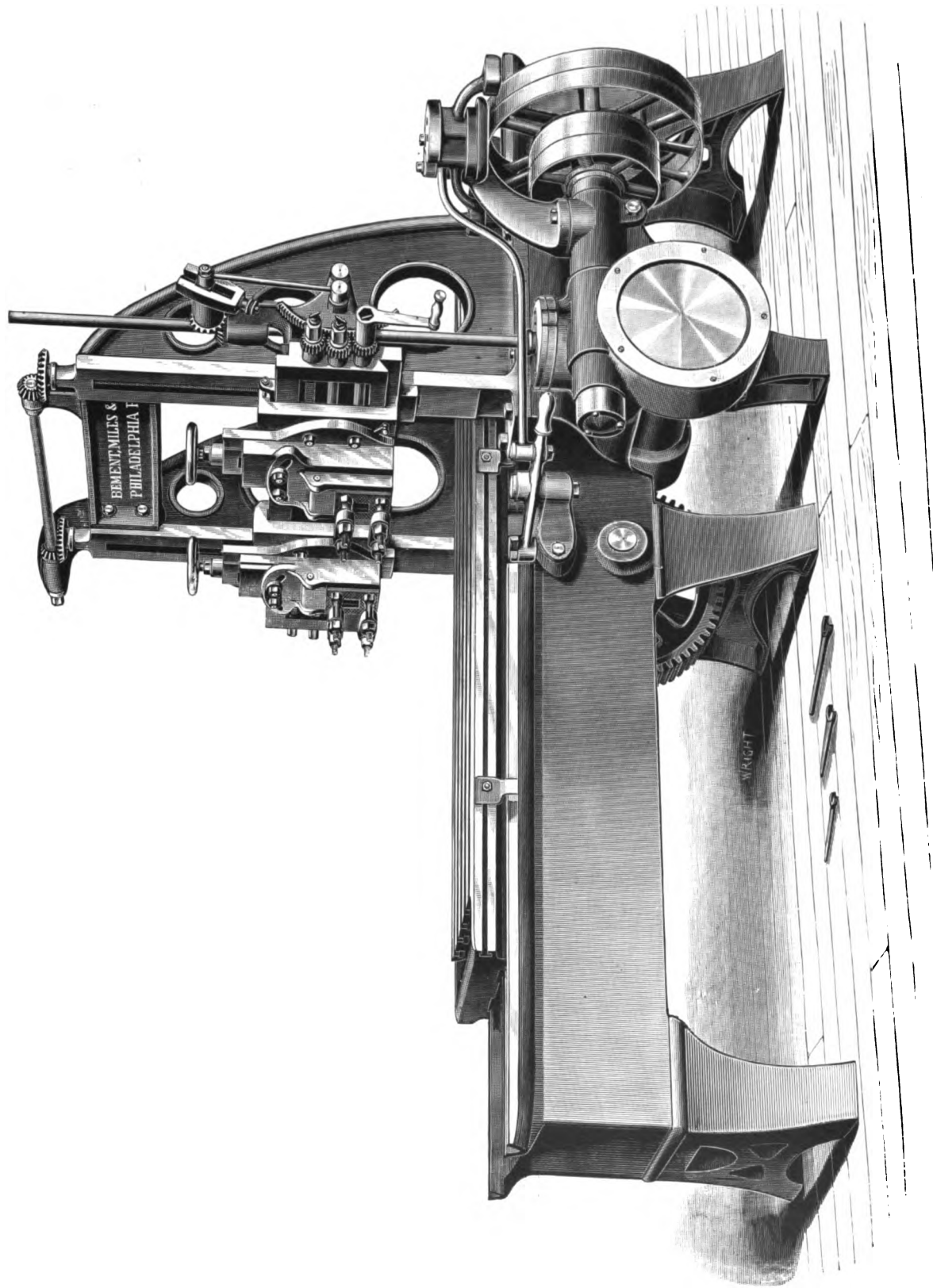
17-INCH PLANING MACHINE.

17-INCH PLANING MACHINE.

Planes 17 inches wide, 17 inches high and 45 inches long. Stands parallel with line shafting and is driven by worm and cut gearing, giving a return motion to the table of 100 feet per minute, if desired. Table is gibbed to the bed to prevent the possibility of lifting under heavy cuts. Forward and backward movements by two belts, separately shifted by a cam, so arranged that the table may be stopped at any position by the reverse lever while the belts are running. Feed variable and self-acting at all angles, in either direction and at either end of the cut. Movement of tool slide on saddle, 8 inches. Bed made unusually strong in the central portion. Countershaft and wrenches included.

20-INCH PLANING MACHINE.

Planes 20 $\frac{3}{4}$ inches wide, 20 $\frac{3}{4}$ inches high, and any required length. Feed variable and self-acting at all angles, in either direction, and at either end of the cut. Table has a return speed of about 100 feet per minute; forward and backward movements of same by two belts separately shifted by a cam, so arranged that the table may be stopped at any position by the reverse lever while the belts are running. Self-oiling rollers for lubricating the table bearing on bed. Bed made unusually strong in the central portion. Countershaft and wrenches included.



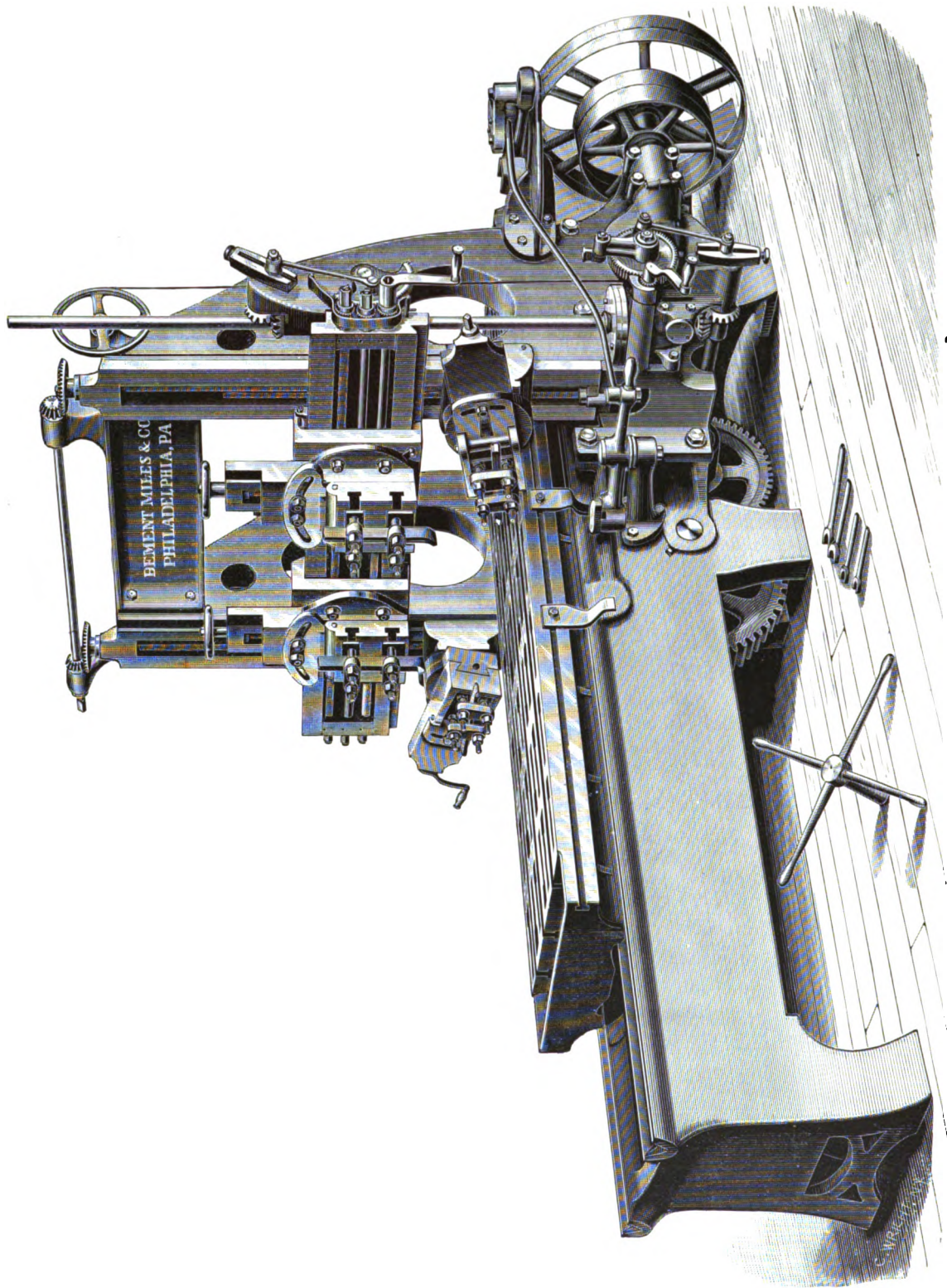
25-INCH PLANING MACHINE.

25-INCH PLANING MACHINE.

Planes 26 inches wide, 26 inches high, and any required length. Driven by worm and cut gearing, giving a noiseless return speed to the table of 100 feet per minute, if desired. Forward and backward movements by two belts, separately shifted by a cam, so arranged that the table may be stopped, at any position, by the reverse lever while the belts are running. Variable feeds, operated directly from the driving works, and self-acting at all angles, in either direction and at either end of the cut. Movement of tool slide on saddle, $7\frac{3}{4}$ inches. When required, a second head, on a separate screw, feeding independently in all directions, may be added. Bed made unusually strong in the central portion. Self-oiling rollers, etc., for lubricating the table. Countershaft and wrenches included.

30-INCH PLANING MACHINE.

Planes 31 inches wide, 31 inches high, and any required length. Driving works so arranged as to bring the machine parallel with line shafting. Variable feeds, operated directly from the driving works, and self-acting at all angles, in either direction, and at either end of the cut. Table driven by cut-rack and gearing, with a return speed of eighty feet or more per minute. Forward and backward movements are effected by two belts, separately shifted in such a manner that the table may be instantly stopped, at any position, by the reverse lever while the belts are running. When required, a second head on the cross slide, feeding independently in all directions, with a separate screw, may be added. When two heads are used, the cross slide is increased in length to enable each tool to cut across the entire space between the uprights; and each head is made one-sided to permit the tools to work as near together as practicable. All the adjustments for varying the feeds are arranged conveniently for the operator on the cross head near the patented reversing latches, which are placed for safety and facility at the outer ends of the cross shaft and screws. Bed is made unusually strong in the central portion; and has oil pockets with rollers for lubricating the table. Countershaft and the necessary wrenches included.



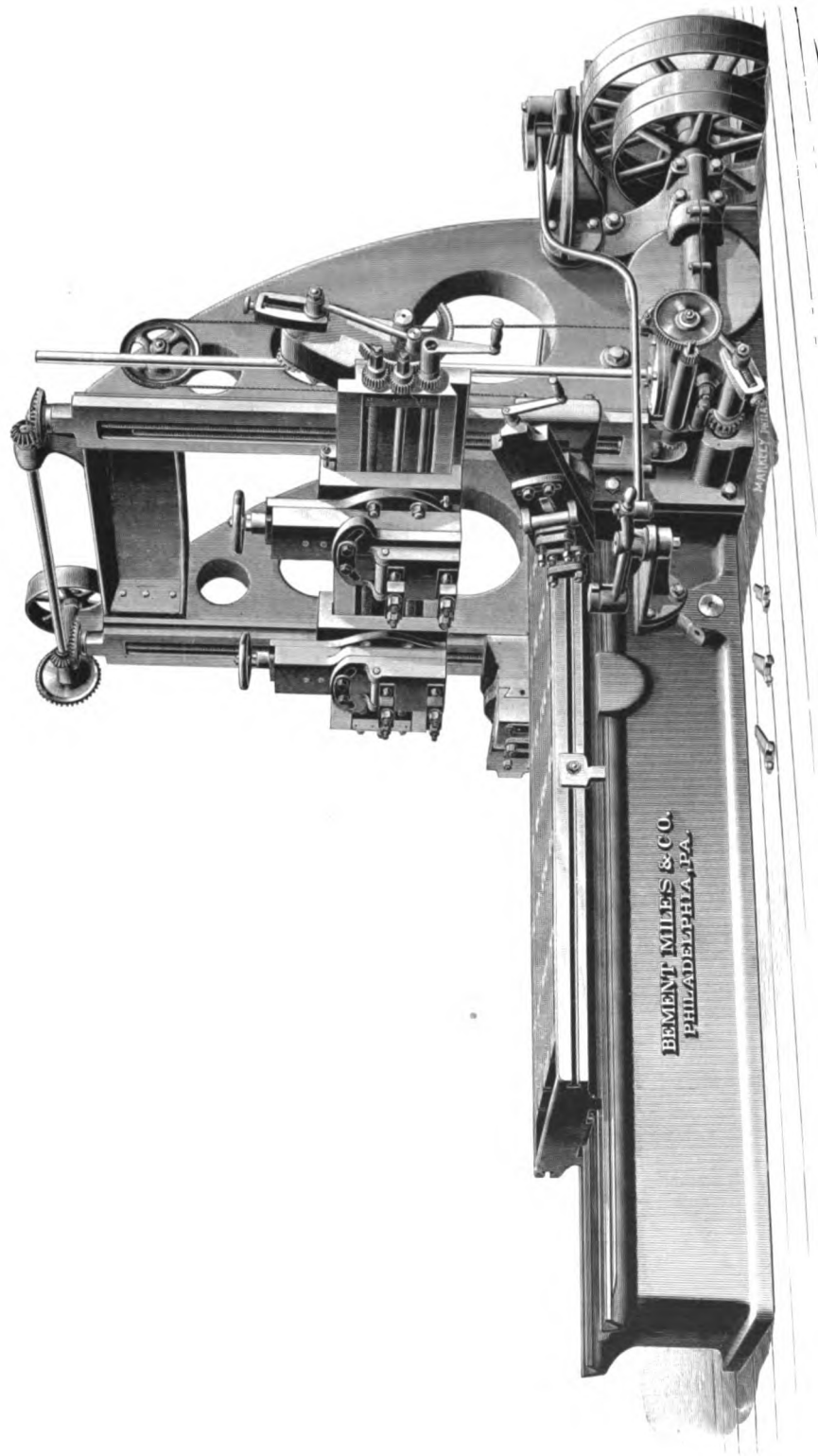
36-INCH PLANING MACHINE.

36-INCH PLANING MACHINE.

Planes 37 inches wide, 37 inches high, and any required length. Driving works so arranged as to bring the machine parallel with line shafting. Variable feeds, operated directly from the driving works, and self-acting at all angles, in either direction, and at either end of the cut. Table driven by cut rack and gearing, with a return speed of eighty feet per minute. Forward and backward movements are effected by two belts, separately shifted in such a manner that the table may be instantly stopped, at any position, by the reverse lever while the belts are running. When required, a second head on the cross slide, feeding independently in all directions, with a separate screw, may be added; also a counterbalanced side head on either, or both, of the uprights, fitted with a compound slide for cutting at any angle, with variable automatic feeds in both directions from below the table to the highest position of the cross slide, thus giving to all the heads the full traverse of the machine. When two heads are used on the cross slide, it is increased in length to enable each tool to cut across the entire space between the uprights; and each head is made one-sided to permit the tools to work as near together as practicable. All the adjustments for varying the feed are arranged conveniently for the operator on the cross head near the patented reversing latches, which are placed for safety and facility at the outer ends of the cross shaft and screws. A substantial automatic tool lifter will be provided when required. Bed is made unusually strong in the central portion; and has oil pockets with rollers for lubricating the table. Countershaft and the necessary wrenches included.

42-INCH PLANING MACHINE.

Planes 43 inches wide, 43 inches high, and any required length. Driving works so arranged as to bring the machine parallel with line shafting. Variable feeds, operated directly from the driving works, and self-acting at all angles, in either direction, and at either end of the cut. Table driven by cut rack and gearing, with a return speed of seventy to eighty feet per minute. Forward and backward movements are effected by two belts, separately shifted in such a manner that the table may be instantly stopped, at any position, by the reverse lever while the belts are running. When required a second head on the cross slide, feeding independently in all directions, with a separate screw, may be added; also a counterbalanced side head on either, or both, of the uprights, fitted with a compound slide for cutting at any angle, with variable automatic feeds in both directions from below the table to the highest position of the cross slide, thus giving to all the heads the full traverse of the machine. When two heads are used on the cross slide, it is increased in length to enable each tool to cut across the entire space between the uprights; and each head is made one-sided to permit the tools to work as near together as practicable. All the adjustments for varying the feeds are arranged conveniently for the operator on the cross head near the patented reversing latches, which are placed for safety and facility at the outer ends of the cross shaft and screws. A substantial automatic tool lifter will be provided when required. Bed is made unusually strong in the central portion; and has oil pockets with rollers for lubricating the table. The table may be stopped, or reversed, from either side of the bed. Cross slide raised and lowered by power, from the countershaft, through a device which cannot operate except while the machine is otherwise at rest, preventing any possible damage to the work. Countershaft and the necessary wrenches included.



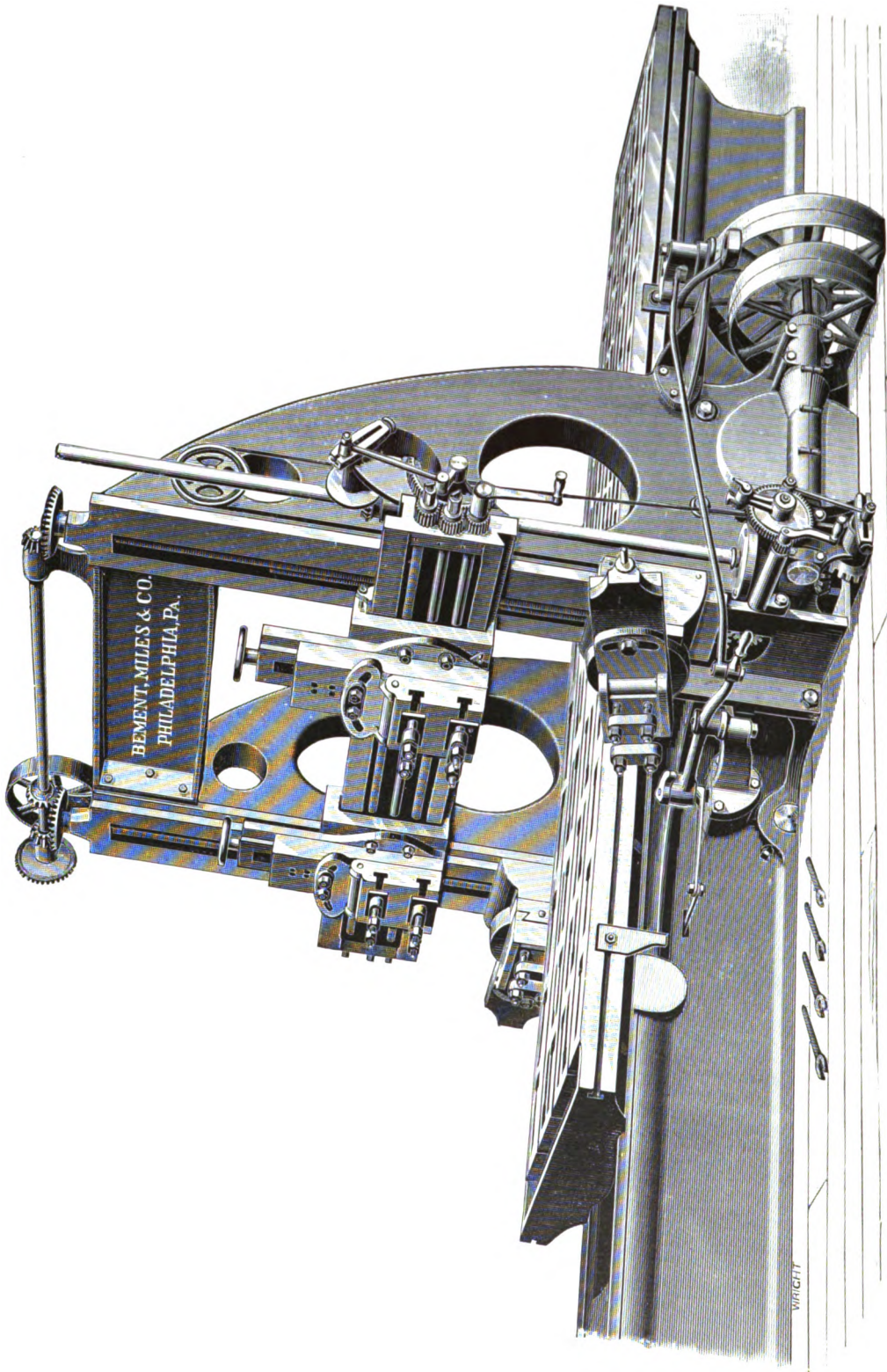
48-INCH PLANING MACHINE.

48-INCH PLANING MACHINE.

Planes 49 inches wide, 49 inches high, and any required length. Driving works so arranged as to bring the machine parallel with line shafting. Variable feeds, operated directly from the driving works, and self-acting at all angles, in either direction, and at either end of the cut. Table driven by cut rack and gearing, with a return speed of seventy to eighty feet per minute. Forward and backward movements are effected by two belts, separately shifted in such a manner that the table may be instantly stopped, at any position, by the reversed lever while the belts are running. When required, a second head on the cross slide, feeding independently in all directions, with a separate screw, may be added; also a counterbalanced side head on either, or both, of the uprights, fitted with a compound slide for cutting at any angle, with variable automatic feeds in both directions from below the table to the highest position of the cross slide, thus giving to all the heads the full traverse of the machine. When two heads are used on the cross slide, it is increased in length to enable each tool to cut across the entire space between the uprights; and each head is made one-sided to permit the tools to work as near together as practicable. All the adjustments for varying the feeds are arranged conveniently for the operator on the cross head near the patented reversing latches, which are placed for safety and facility at the outer ends of the cross shaft and screws. A substantial automatic tool lifter will be provided when required. Bed is made unusually strong in the central portion; and has oil pockets with rollers for lubricating the table. The table may be stopped, or reversed, from either side of the bed. Cross slide raised and lowered by power, from the countershaft, through a device which cannot operate except while the machine is otherwise at rest, preventing any possible damage to the work. Countershaft and the necessary wrenches included.

54-INCH PLANING MACHINE.

Planes 55 inches wide, 55 inches high, and any required length. Driving works so arranged as to bring the machine parallel with line shafting. Variable feeds, operated directly from the driving works, and self-acting at all angles, in either direction, and at either end of the cut. Table driven by cut rack and gearing, with a return speed of seventy to eighty feet per minute. Forward and backward movements are effected by two belts, separately shifted in such a manner that the table may be instantly stopped, at any position, by the reverse lever while the belts are running. When required, a second head on the cross slide, feeding independently in all directions, with a separate screw, may be added; also a counterbalanced side head on either, or both, of the uprights, fitted with a compound slide for cutting at any angle, with variable automatic feeds in both directions from below the table to the highest position of the cross slide, thus giving to all the heads the full traverse of the machine. When two heads are used on the cross slide, it is increased in length to enable each tool to cut across the entire space between the uprights; and each head is made one-sided to permit the tools to work as near together as practicable. All the adjustments for varying the feeds are arranged conveniently for the operator on the cross head near the patented reversing latches, which are placed for safety and facility at the outer ends of the cross shaft and screws. A substantial automatic tool lifter will be provided when required. Bed is made unusually strong in the central portion; and has patented oil pockets with rollers for lubricating the table. The table may be stopped, or reversed, from either side of the bed. Cross slide raised and lowered by power, from the countershaft, through a device which cannot operate except while the machine is otherwise at rest, preventing any possible damage to the work. Countershaft and the necessary wrenches included.



72-INCH PLANING MACHINE.

60-INCH PLANING MACHINE.

Planes 62 inches wide, 61 inches high, and any required length. Driving works so arranged as to bring the machine parallel with line shafting. Variable feeds, operated directly from the driving works, and self-acting at all angles, in either direction, and at either end of the cut. Table driven by cut rack and gearing, with a return speed of seventy to eighty feet per minute. Forward and backward movements are effected by two belts, separately shifted in such a manner that the table may be instantly stopped, at any position, by the reverse lever while the belts are running. When required, a second head on the cross slide, feeding independently in all directions, with a separate screw, may be added; also a counterbalanced side head on either, or both, of the uprights, fitted with a compound slide for cutting at any angle, with variable automatic feeds in both directions from below the table to the highest position of the cross slide, thus giving to all the heads the full traverse of the machine. When two heads are used on the cross slide, it is increased in length to enable each tool to cut across the entire space between the uprights; and each head is made one-sided to permit the tools to work as near together as practicable. All the adjustments for varying the feeds are arranged conveniently for the operator on the cross head near the patented reversing latches, which are placed for safety and facility at the outer ends of the cross shaft and screws. A substantial automatic tool lifter will be provided when required. Bed is made unusually strong in the central portion; and has patented oil pockets with rollers for lubricating the table. The table may be stopped, or reversed, from either side of the bed. Cross slide raised and lowered by power, from the countershaft, through a device which cannot operate except while the machine is otherwise at rest, preventing any possible damage to the work. Countershaft and the necessary wrenches included.

72-INCH PLANING MACHINE.

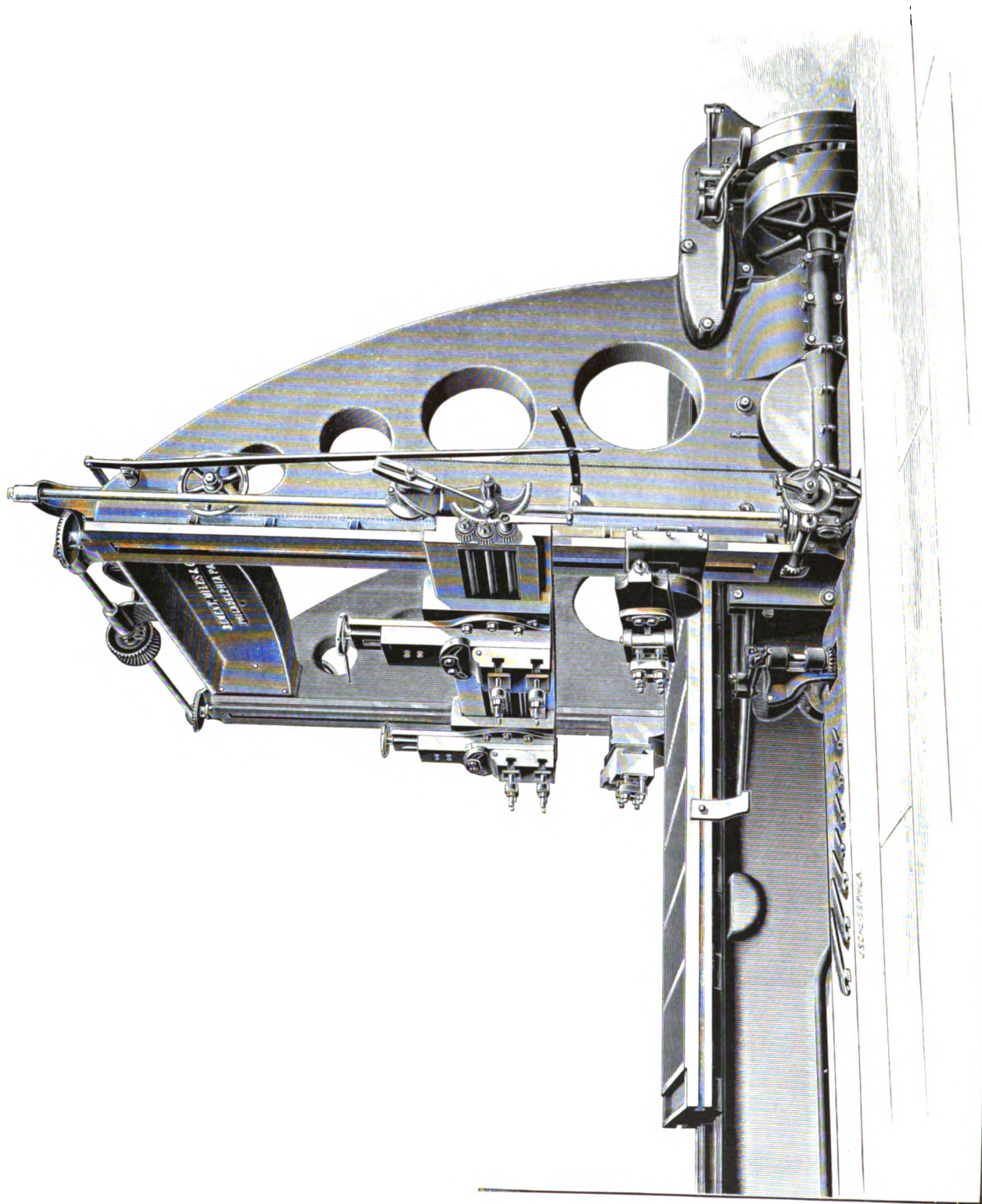
Planes 73 inches wide, 73 inches high, and any required length. Driving works so arranged as to bring the machine parallel with line shafting. Variable feeds, operated directly from the driving works, and self-acting at all angles, in either direction, and at either end of the cut. Table driven by cut rack and gearing, with a return speed of seventy to eighty feet per minute. Forward and backward movements are effected by two belts separately shifted in such a manner that the table may be instantly stopped, at any position, by the reverse lever while the belts are running. When required, a second head on the cross slide, feeding independently in all directions, with a separate screw, may be added; also a counterbalanced side head on either, or both, of the uprights, fitted with a compound slide for cutting at any angle, with variable automatic feeds in both directions from below the table to the highest position of the cross slide, thus giving to all the heads the full traverse of the machine. When two heads are used on the cross slide, it is increased in length to enable each tool to cut across the entire space between the uprights; and each head is made one-sided to permit the tools to work as near together as practicable. All the adjustments for varying the feeds are arranged conveniently for the operator on the cross head near the patented reversing latches, which are placed for safety and facility at the outer ends of the cross shaft and screws. A substantial automatic tool lifter will be provided when required. Bed is made unusually strong in the central portion; and has patented oil pockets with rollers for lubricating the table. The table may be stopped, or reversed, from either side of the bed. Cross slide raised and lowered by power, from the countershaft, through a device which cannot operate except while the machine is otherwise at rest, preventing any possible damage to the work. Countershaft and the necessary wrenches included.

84-INCH PLANING MACHINE.

Planes 85 inches wide, 85 inches high, and any required length. Driving works so arranged as to bring the machine parallel with line shafting. Variable feeds, operated directly from the driving works and self-acting at all angles, in either direction, and at either end of the cut. Table driven by cut rack and gearing, with a return speed of seventy to eighty feet per minute. Forward and backward movements are effected by two bolts, separately shifted in such a manner that the table may be instantly stopped, at any position, by the reverse lever while the belts are running. When required, a second head on the cross slide, feeding independently in all directions, with a separate screw, may be added; also a counterbalanced side head on either, or both, of the uprights, fitted with a compound slide for cutting at any angle, with variable automatic feeds in both directions from below the table to the highest position of the cross slide, thus giving to all the heads the full traverse of the machine. When two heads are used on the cross slide, it is increased in length to enable each tool to cut across the entire space between the uprights; and each head is made one-sided to permit the tools to work as near together as practicable. All the adjustments for varying the feeds are arranged conveniently for the operator on the cross head near the patented reversing latches, which are placed for safety and facility at the outer ends of the cross shaft and screws. A substantial automatic tool lifter will be provided when required. Bed is made unusually strong in the central portion; and has patented oil pockets with rollers for lubricating the table. The table may be stopped, or reversed, from either side of the bed. Cross slide raised and lowered by power, from the countershaft, through a device which cannot operate except while the machine is otherwise at rest, preventing any possible damage to the work. Countershaft and the necessary wrenches included.

96-INCH PLANING MACHINE.

Planes 98 inches wide, 98 inches high, and any required length. Driving works so arranged as to bring the machine parallel with line shafting, unless otherwise ordered. Variable feeds, operated directly from the driving works, and self-acting at all angles, in either direction, and at either end of the cut. Table driven by cut rack and gearing, with a return speed of sixty or more feet per minute. Forward and backward movements are effected by two belts, separately shifted in such a manner that the table may be instantly stopped, at any position, by the reverse lever while the belts are running. When required, a second head on the cross slide, feeding independently in all directions, with a separate screw, may be added; also a counterbalanced side head, on either, or both, of the uprights, fitted with a compound slide for cutting at any angle, with variable automatic feeds in both directions from below the table to the highest position of the cross slide, thus giving to all the heads the full traverse of the machine. When two heads are used on the cross slide it is increased in length to enable each tool to cut across the entire space between the uprights; and each head is made one-sided to permit the tools to work as near together as practicable. All the adjustments for varying the feeds are arranged conveniently for the operator on the cross head near the patented reversing latches, which are placed for safety and facility at the outer ends of the cross shaft and screws. A substantial automatic tool lifter, contained within the cross slide, will be provided when required. Bed is made unusually strong in the central portion; and has patented oil pockets with rollers for lubricating the table. The table may be stopped, or reversed, from either side of the bed. Cross slide raised and lowered by power, from the countershaft, through a device which cannot operate except while the machine is otherwise at rest, preventing any possible damage to the work. Countershaft and the necessary wrenches included.



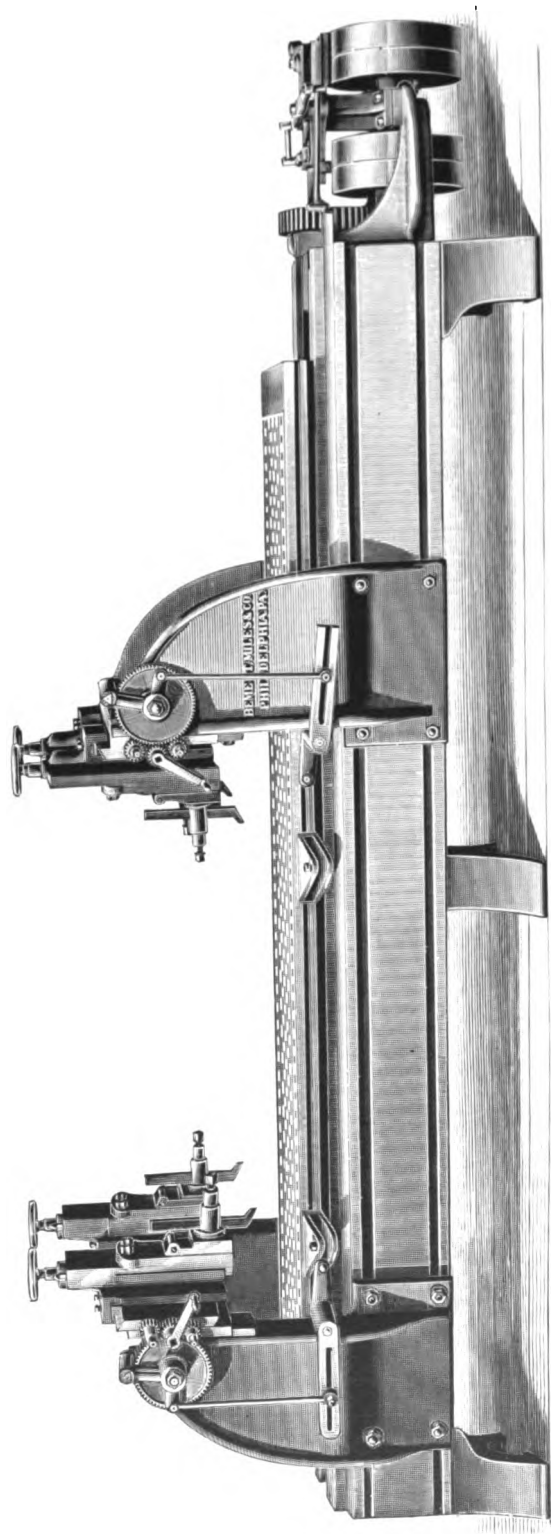
120-INCH PLANING MACHINE.

120-INCH PLANING MACHINE.

Planes 122 inches wide, 122 inches high, and any required length. Driving works so arranged as to bring the machine parallel with line shafting, unless otherwise ordered. Variable feeds, operated directly from the driving works, and self-acting at all angles, in either direction, and at either end of the cut. Table driven by cut rack and gearing, with a return speed of sixty feet per minute. Forward and backward movements are effected by two belts, separately shifted in such a manner that the table may be instantly stopped, at any position, by the reverse lever while the belts are running. When required, a second head on the cross slide, feeding independently in all directions, with a separate screw, may be added; also a counterbalanced side head on either, or both, of the uprights, fitted with a compound slide for cutting at any angle, with variable automatic feeds in both directions from below the table to the highest position of the cross slide, thus giving to all the heads the full traverse of the machine. When two heads are used on the cross slide it is increased in length to enable each tool to cut across the entire space between the uprights; and each head is made one-sided to permit the tools to work as near together as practicable. All the adjustments for varying the feeds are arranged conveniently for the operator on the cross head near the patented reversing latches, which are placed for safety and facility at the outer ends of the cross shaft and screws. A substantial automatic tool lifter, contained within the cross slide, will be provided when required. Bed is made unusually strong in the central portion; and has oil pockets with rollers for lubricating the table. The table may be stopped, or reversed, from either side of the bed. Cross slide raised and lowered by power, from the countershaft, through a device which cannot operate except while the machine is otherwise at rest, preventing any possible damage to the work. Countershaft and the necessary wrenches included.

144-INCH PLANING MACHINE.

Planes 146 inches wide, 146 inches high, and any required length. As this machine is similar in design to the 120-inch, no special description of it is necessary. Owing, however, to the greater width, we are prepared to furnish, when required, three independent heads for the cross slide. Our largest planers are sometimes provided with broad flat table bearings with lateral adjustment for wear, instead of the usual V's.

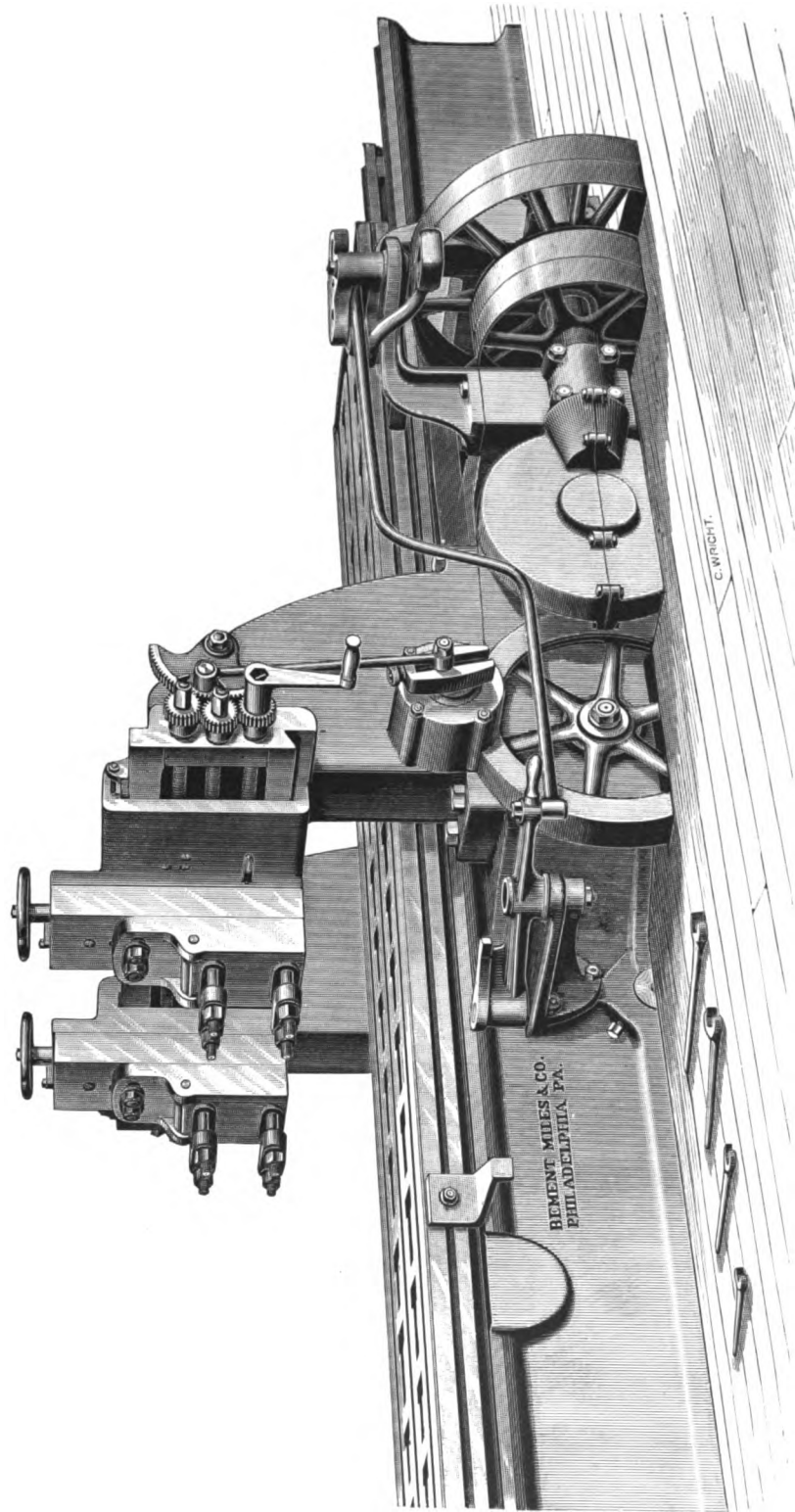


CONNECTING-ROD PLANING MACHINE.

CONNECTING-ROD PLANING MACHINE.

Planes 36 inches wide, and 9 inches high. Has two pairs of independent heads on opposite cross slides, movable to any position on bed. Tool slides have a vertical traverse of $8\frac{1}{2}$ inches, and variable automatic feed at right angles. Movement of table is by screw and gearings driven by two belts separately shifted. Countershaft and wrenches included.

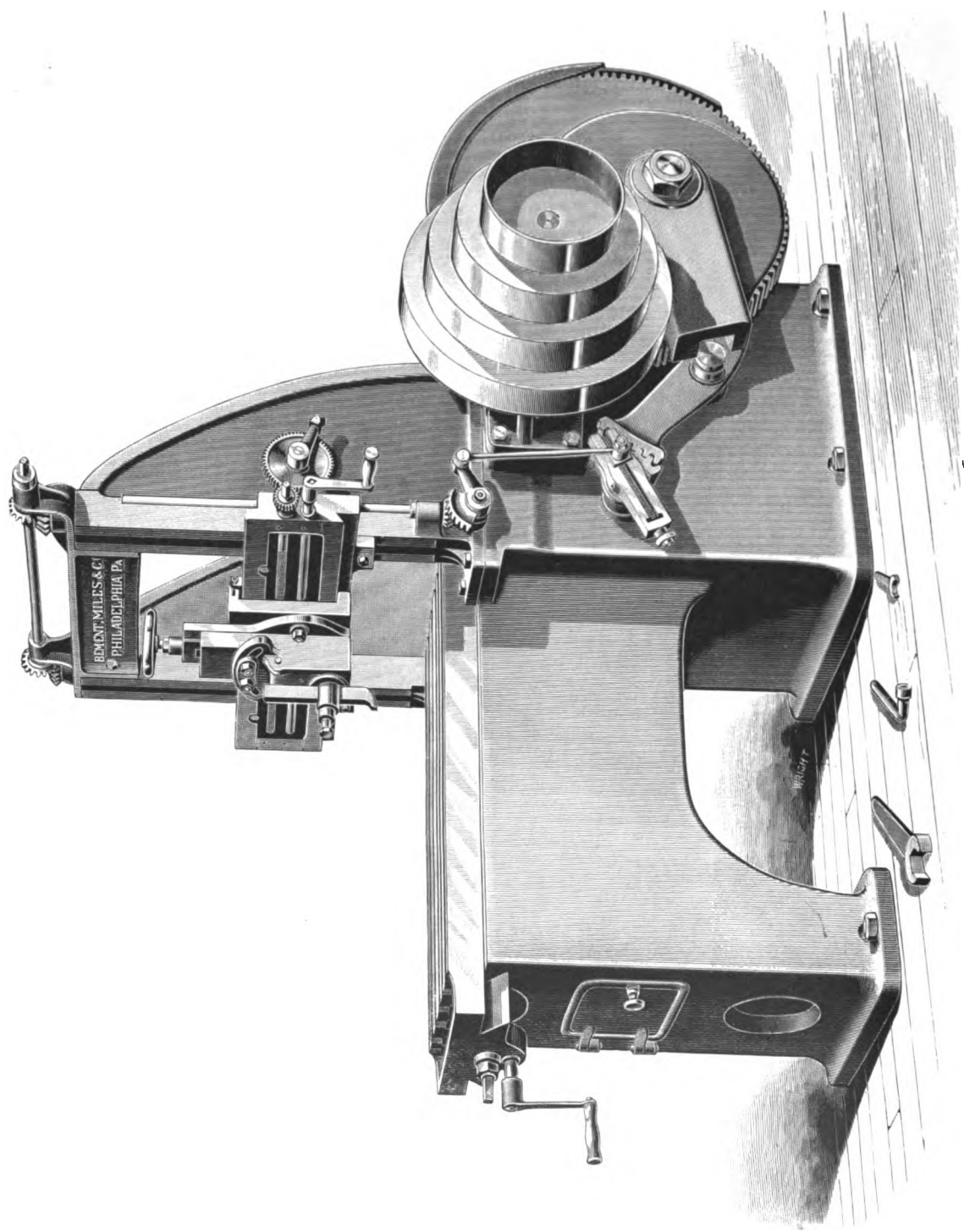
We also build the foregoing machine with uprights, permitting a vertical adjustment of the cross slides through a distance of 30 inches. In this case the cross slides, heads, posts, etc., are taken from our standard 30-inch planer.



FROG AND SWITCH PLANING MACHINE.

FROG AND SWITCH PLANING MACHINE.

Planes 37 inches wide, and any required length. Driving shaft is parallel with bed, bringing the machine in line with overhead shafting. Cross head is fixed, usually at a clear height of 9 inches above table. Two heads on cross slide, each with independent variable feed motions, horizontal and vertical, operated directly from driving works, and using no power except at the moment of feeding. Table driven by rack and gearing of sufficient strength to carry two of the heaviest cuts on steel rails. Driving gear operated by two belts separately shifted, and arranged to produce a suitable cutting speed for steel with very rapid return movement. Countershaft and wrenches included.



24-INCH CRANK PLANING MACHINE.

17-INCH CRANK PLANING MACHINE.

Planes 17 inches wide, 17 inches high, and 17 inches long. The driving gear has 4 changes of speed to suit the various strokes, as well as the different materials to be worked, and has a quick return movement. The table is gibbed to the bed to prevent the possibility of lifting under heavy cuts, and the adjustment of the stroke, as well as the clamping of the nut, is effected from the front end of table. Movement of tool slide on saddle, 6 inches. A friction brake is applied so that the machine can be stopped instantly at any point of its stroke. The feed gear is positive, variable and self-acting in all directions—horizontal, vertical and angular. If it be desired that one man should run two of these machines, they can be made right and left, and operated from one position. Countershaft and wrenches included.

24-INCH CRANK PLANING MACHINE.

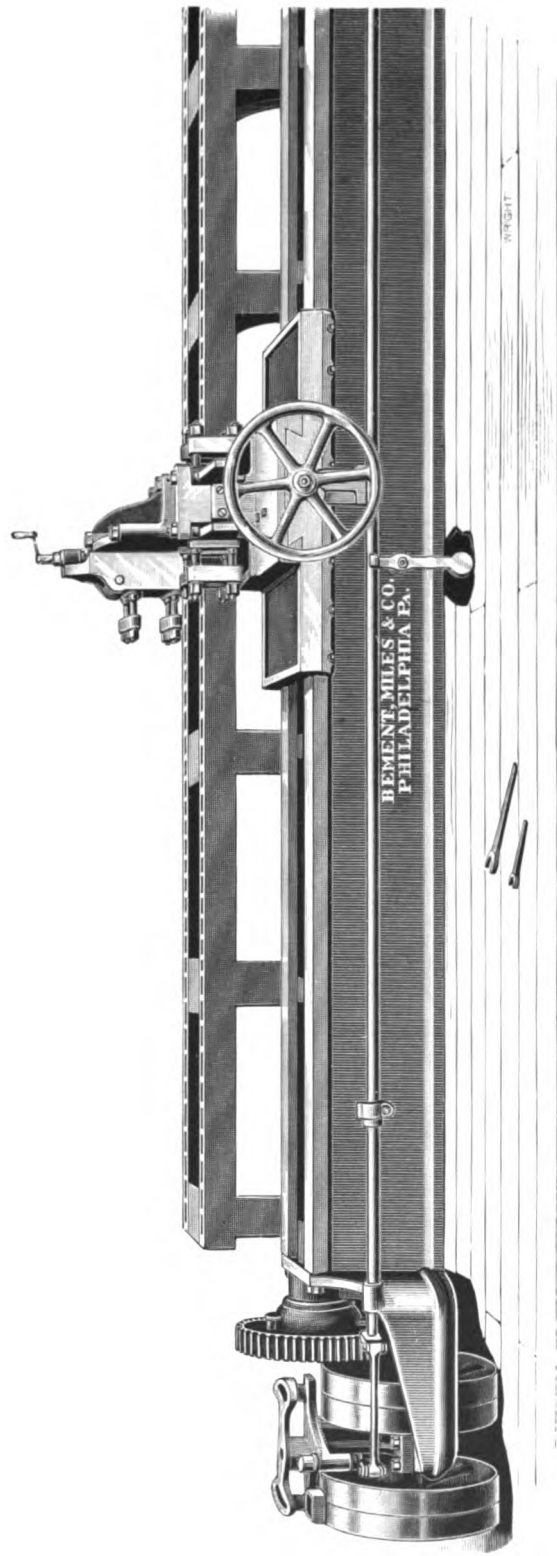
Planes 20 inches wide, 20 inches high, and 24 inches long. The driving gear has four changes of speed, to suit the various strokes, as well as the different materials to be worked, and has a quick return motion. The table is gibbed to the bed to prevent the possibility of lifting under heavy cuts, and the adjustment of the stroke, as well as the clamping of the nut, is effected from the front end of table. Movement of tool slide on saddle, 6½ inches. A friction brake is applied so that the machine can be stopped instantly at any point of its stroke. The feed gear is variable and self-acting in all directions. If it be desired that one man should run two of these machines, they can be made right and left and operated from one point. Countershaft and wrenches included.



No. 1 PLATE-PLANING MACHINE.

No. 1 PLATE-PLANING MACHINE.

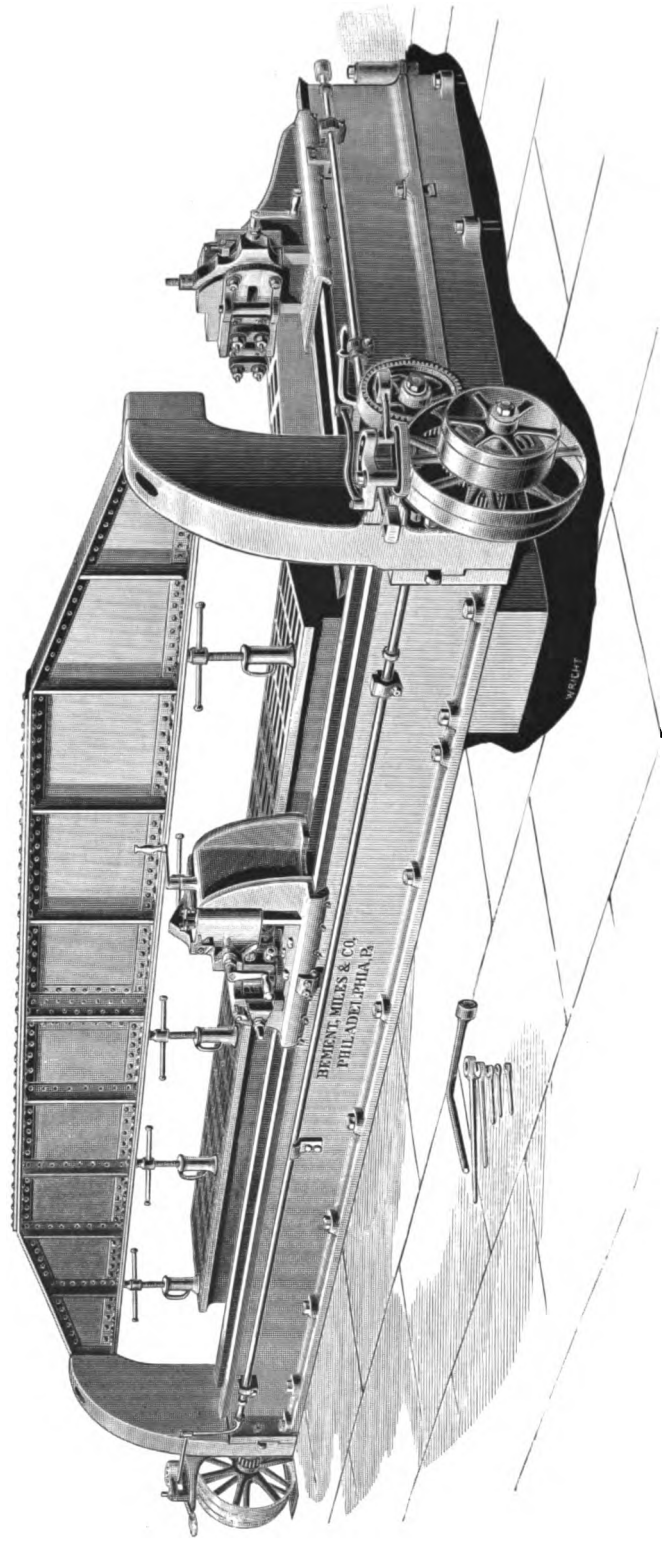
Can be built to plane any length up to 30 feet at one setting, and will take a heavy cut on one-inch plates. The plate is stationary and is screwed to the table by a rigid wrought-iron clamping bar, raised and lowered by two screws geared together and operated from one position. The housings are so arranged that plates of any length can be planed by shifting. Carriage is driven by screw and gearing and has two tool slides cutting in opposite directions, each having a relief apron, and one being provided with a vertical and angular feed, in addition to its horizontal movements. Two belts, separately shifted, are used for the forward and backward movements of tool carriage. Countershaft and wrenches included.



No. 2 PLATE-PLANING MACHINE.

No. 2 PLATE-PLANING MACHINE.

For planing plates one inch or more in thickness and up to 28 feet in length; or any length by shifting. It has no clamping bar, but the table attached to the bed is made of such width that the plates may be secured in any position by bolting. Carriage is driven by screw and gearing and has two tool heads cutting in opposite directions, also a third placed above the others with vertical and angular feed. Two belts, separately shifted, are used for the forward and backward motions of carriage. Countershaft and wrenches included.



No. 4 PLATE-PLANING MACHINE.

No. 3 PLATE-PLANING MACHINE.

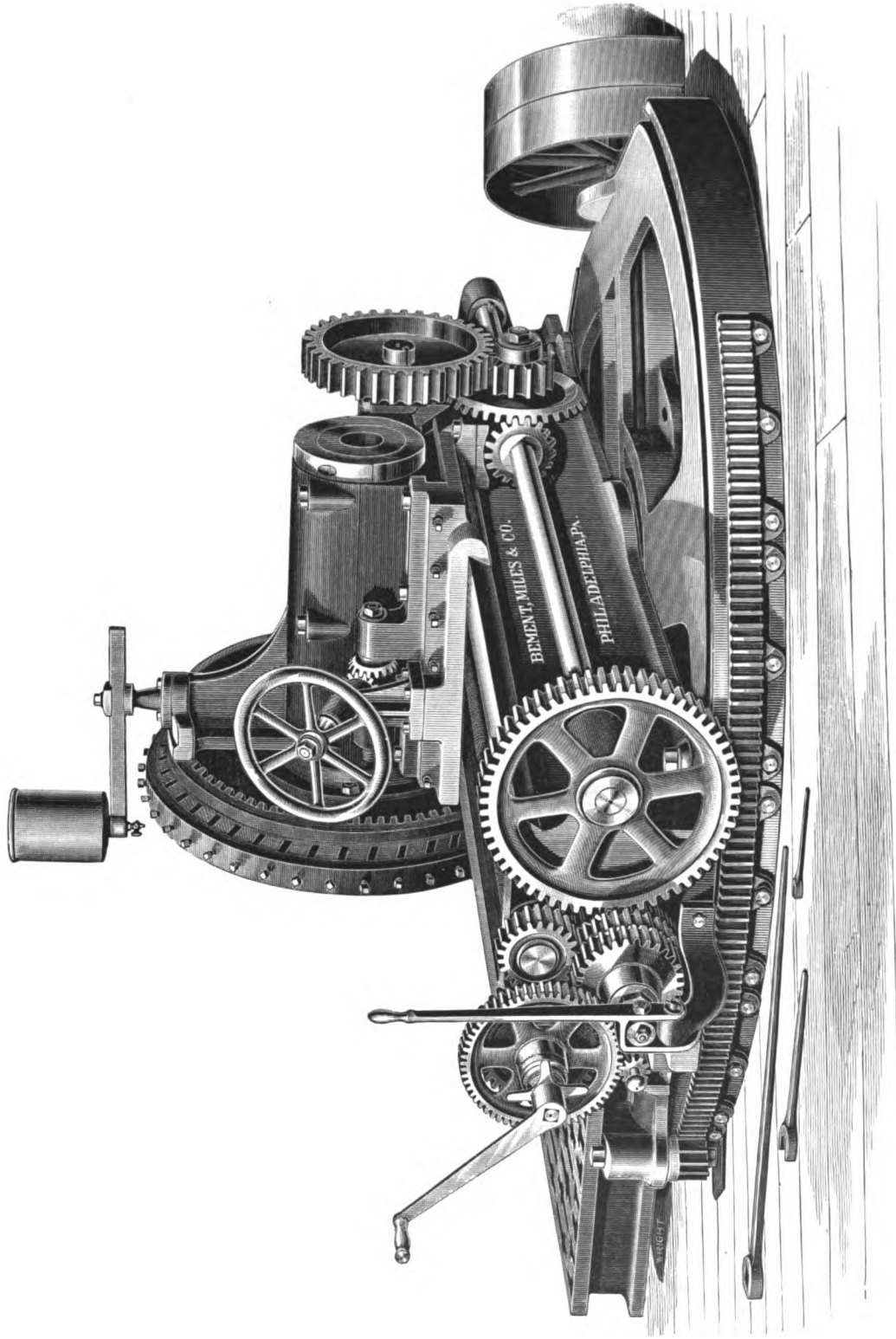
For planing plates 2 inches thick and up to 24 feet in length, or any length by shifting. The plates are screwed to the table by a rigid clamping bar of wrought iron, raised and lowered by a screw at each end, geared together and operated from one position. Carriage is driven by screw and gearing, and has two tool heads cutting in opposite directions, each having a relief apron and one being provided with a vertical and angular feed in addition to its horizontal movements. Two belts, separately shifted, are used for the forward and backward movements of carriage. This machine may be built for longer or shorter plates than the above. It may also have a series of intermediate screws for a fixed clamping bar, instead of the movable bar operated by one screw at each end. Countershaft and wrenches included.

No. 4 PLATE-PLANING MACHINE.

Can be constructed to plane two sides of 1 inch to 1½ inch plates up to 30 feet in length, by 10 feet in width, at one setting, or any length by shifting. The clamping bar is fixed in position, with ample working area, and the plate is held by a number of screw jacks which can be quickly applied and removed. The shorter edge of the plate is clamped to the transverse table. The main carriage for planing lengthwise is provided with two tool slides, to plane in opposite directions, and one of them has a vertical adjustment with a swivel for cutting a strip off the edge of a sheet and for planing internal angles. The transverse bed is arranged to swivel on a base plate, giving a variation of about ten degrees in either direction from a right angle, and its tool carriage has a quick return motion, as, owing to the shorter cut, only one tool is required. Two belts, separately shifted, are used for the forward and backward movements of carriages. An automatic stop motion effectually prevents the carriages from coming into contact. Includes two countershafts and the necessary wrenches.

No. 5 PLATE-PLANING MACHINE.

Will plane plates 2 to 3 inches in thickness and can be built for any length up to 30 feet, by 10 feet in width, or any length by shifting the plates. Though much heavier, this machine is built in exactly the same manner as the No. 4, and, therefore, requires no special description.



48-INCH ROTARY PLANING MACHINE.

36-INCH ROTARY PLANING MACHINE.

Diameter of cutting circle, 37 inches. Driven by pulleys through a train of gearing into an internal gear on face plate. Saddle has a movement of 7 feet on bed, three changes of automatic feed, and a rapid power movement on bed, in either direction at the rate of 5 feet 8 inches per minute. Spindle bearing is in a transverse slide having an adjustment of 2 inches to regulate the depth of cut. Bed and table are connected, and swivel together through an angle of 180 degrees. Cutters can be ground with an emery wheel without removing them from their place, insuring uniform work from each. The machine may be built without the swivelling arrangement, if required. Countershaft and wrenches included.

48-INCH ROTARY PLANING MACHINE.

Diameter of cutting circle, 49 inches. Driven by pulleys through a train of gearing into an internal gear on face plate. Saddle has a traverse on bed of 8 feet, three automatic feeds, and a rapid power movement on bed, in either direction, at the rate of 6½ feet per minute. Spindle bearing is in a transverse slide having an adjustment of 3 inches by a convenient hand wheel, to regulate the depth of cut. Bed and table are connected, and swivel together on the circular base plate through an angle of 180 degrees. All the movements are from one position convenient to the operator. The machine may be built without the swivelling arrangement if required. Countershaft and wrenches included.

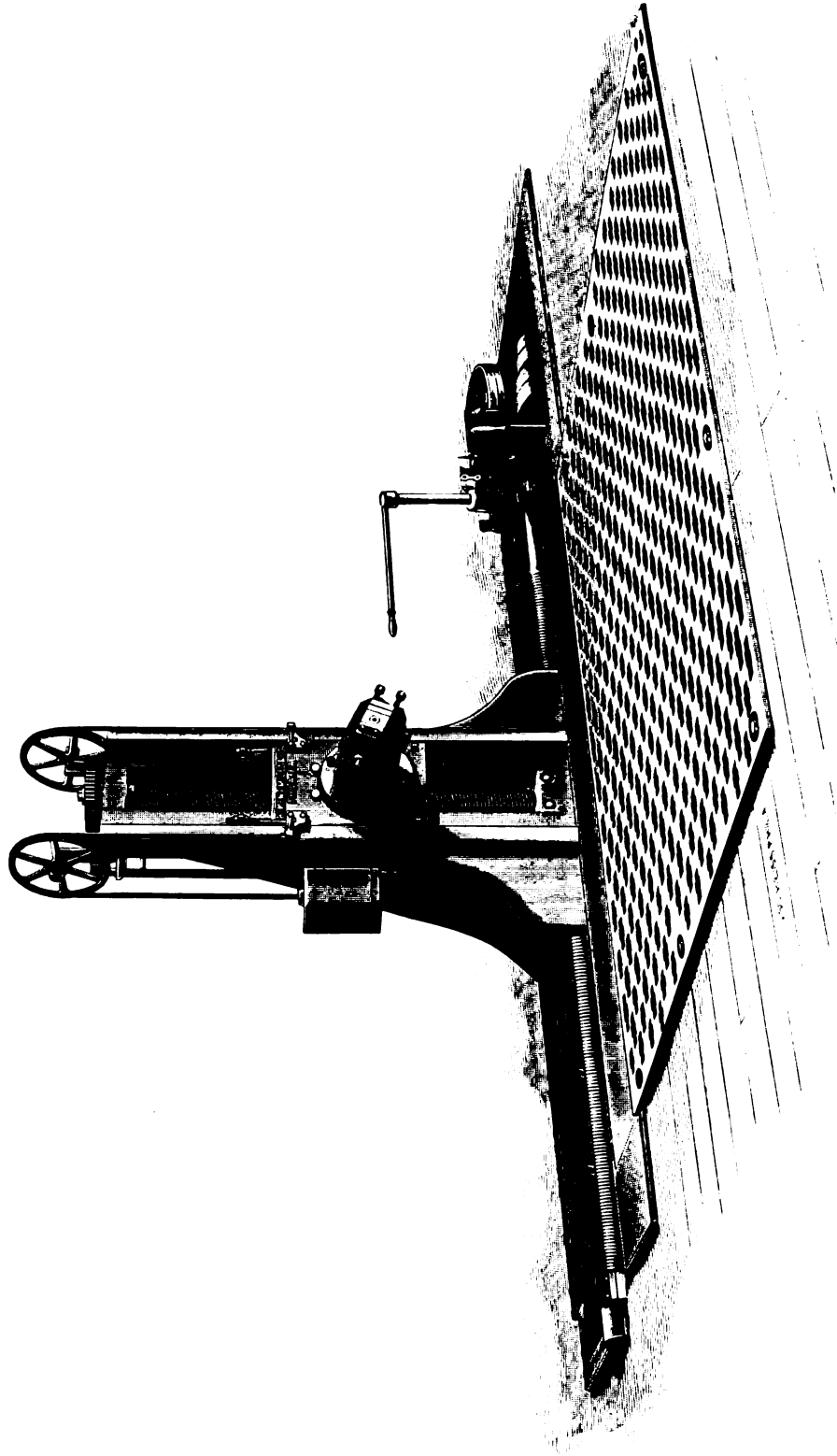


84-INCH ROTARY PLANING MACHINE.

84-INCH ROTARY PLANING MACHINE.

With capacity and power sufficient for planing the edges of the heaviest armor plates. Diameter of cutting circles, 84 inches. Driven by pulleys through a train of gearing into an internal gear on face plate. Saddle has a traverse on bed of 30 feet, but it may be more or less, as required. It has two speeds, three automatic feeds and rapid power movement on bed in either direction at the rate of $17\frac{1}{2}$ feet per minute. Spindle bearing is held in a transverse slide, having an adjustment of $4\frac{1}{2}$ inches by a convenient hand wheel, to regulate the depth of cut. Work bed is $30\frac{1}{2}$ feet long by 8 feet wide. All the movements are from one position, convenient to the operator. Countershaft and wrenches included.

The above machine is sometimes built with a saw 84 inches in diameter, for slitting armor plates, etc.



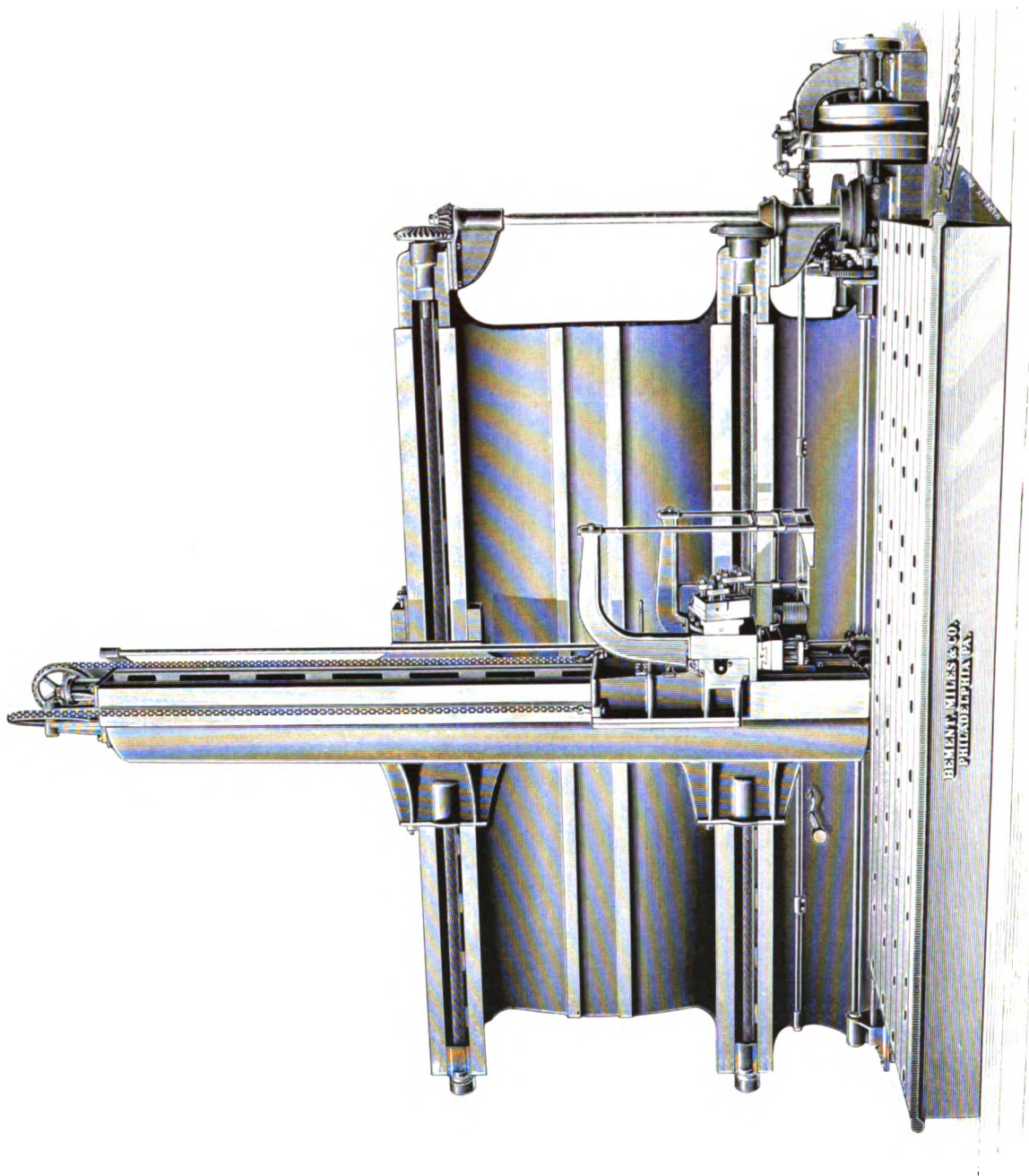
No. 2 VERTICAL AND HORIZONTAL PLANING MACHINE.

No. 1 VERTICAL AND HORIZONTAL PLANING MACHINE.

Planes $5\frac{1}{2}$ feet high, 8 feet long (or longer, if so ordered), slots 54 inches high, and has an incutting feed of 18 inches. Driven by reversing pulleys through suitable gearing to a screw which traverses the post on the bed for horizontal planing, and to a vertical shaft connected with another screw which drives a counterbalanced tool saddle along the post for vertical planing. Both the planing motions have a return speed of four to one. A pawl working in the gear which drives the horizontal screw, operates the feed for vertical planing, and a similar application to the vertical screw, answers a like purpose for horizontal planing. The feeds are variable from $\frac{1}{80}$ inch to $\frac{3}{4}$ inch in width. Work table is usually $8\frac{1}{2}$ feet long by 4 feet wide, but these dimensions may be varied, if required.

No. 2 VERTICAL AND HORIZONTAL PLANING MACHINE.

Planes 9 feet high, 13 feet long (or longer, if so ordered), slots 8 feet high, and has an incutting feed of 20 inches. Driven by reversing pulleys through suitable gearing to a screw which traverses the post on the bed for horizontal planing, and to a vertical shaft connected with another screw which drives a counterbalanced tool saddle along the post for vertical planing. Both the planing motions have a return speed of three to one. A pawl working in the gear which drives the horizontal screw, operates the feed for vertical planing, and a similar application to the vertical screw, answers a like purpose for horizontal planing. The feeds are variable from $\frac{1}{32}$ inch to 1 inch in width. Work table is usually 14 feet long by 6 feet wide, but these dimensions may be varied, if required.



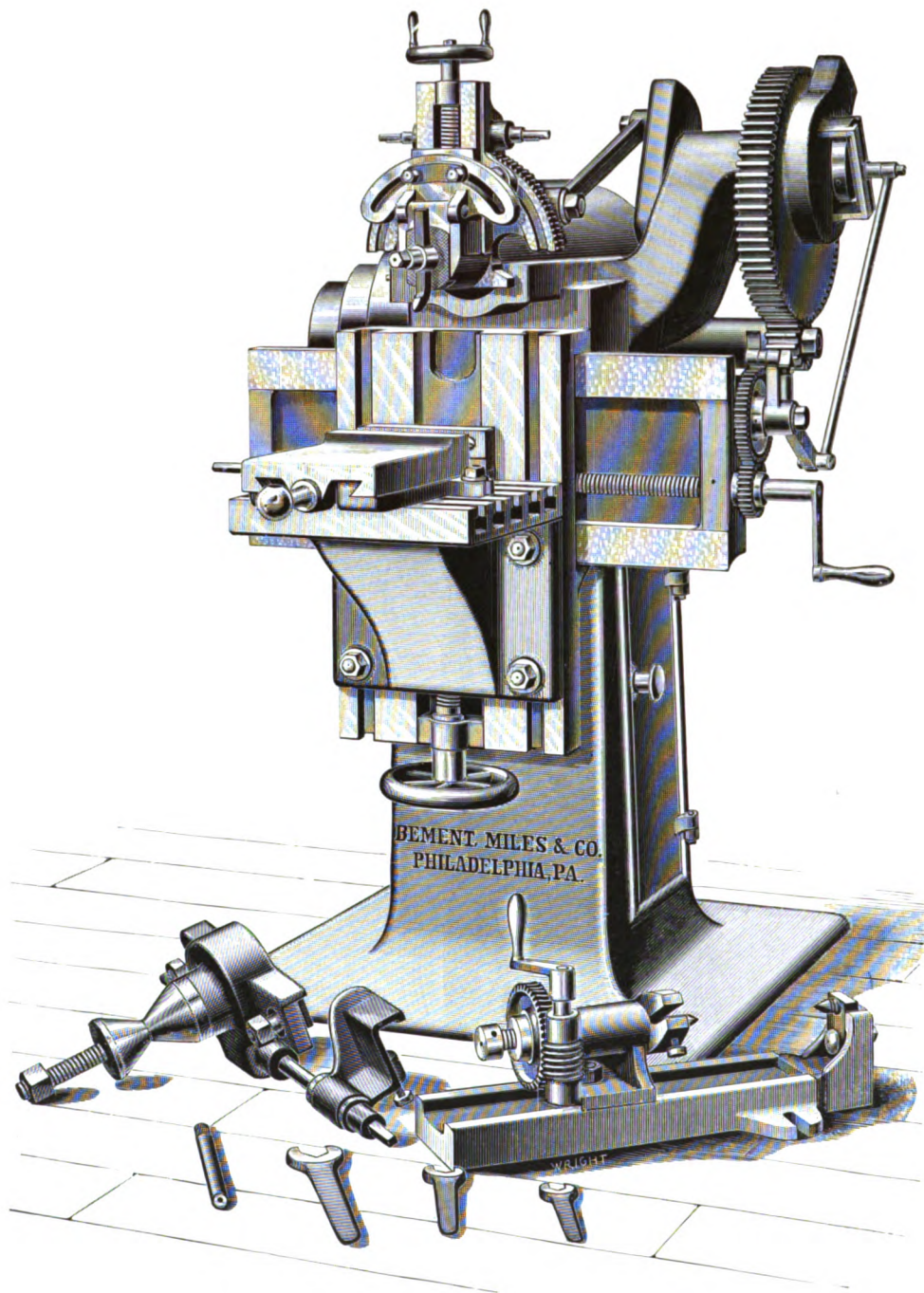
No. 4 VERTICAL AND HORIZONTAL PLANING MACHINE.

No. 3 VERTICAL AND HORIZONTAL PLANING MACHINE.

Planes 14 feet vertically, and 16 (or more) feet horizontally, as may be ordered, with an incutting power feed of 25 inches. The work table, or bed, is usually 19 feet long by 8 feet wide, but these dimensions may be varied. As this machine is exactly similar in arrangement to the No. 4, reference is made to the description of that size, and to the illustration on the opposite page.

No. 4 VERTICAL AND HORIZONTAL PLANING MACHINE.

For marine engine and other castings too large to be worked on an ordinary planing machine, particularly for such pieces as should be planed at right angles at one setting. Planes 22 feet horizontally, or more, if so ordered, and 20 feet vertically; and consists of a work bed, usually 25 feet long by 10 feet wide, with connecting frames to three uprights, to which are bolted the two pieces of the cross slide supporting the upright bar and tool saddle. The cross slide is 13 feet 2 inches wide, and the bearings of the saddle bar are 8 feet long. The motions in each direction are effected by 54-inch reversing pulleys for 5-inch belt, separately shifted, with back motion $2\frac{1}{4}$ times the forward speed. The horizontal screws, when not used for driving, operate the feed for vertical planing and the vertical screw answers a like purpose for horizontal planing. To decrease the momentum of moving parts, an automatic brake operating at each reverse of movement is used. Saddle is counterbalanced, and is furnished with two separately adjustable tool posts for horizontal planing, having an incutting power feed 33 inches through their lower slide, and 18 inches through the upper slide, at any angle, making 51 inches movement in all; also a tool post in a lower position for vertical planing, having 33 inches incutting power feed through its lower slide, and 5 inches through the upper slide, operating within an angle of 45 degrees each way. Feeds are variable from $\frac{1}{16}$ of an inch to 1 inch. All motions are controlled from the platform provided for the workman. Screws are supported their entire length and have thrust bearings of steel, with brass washers, running in oil. The long shafts are supported by tumbler bearings. Countershaft and wrenches included.

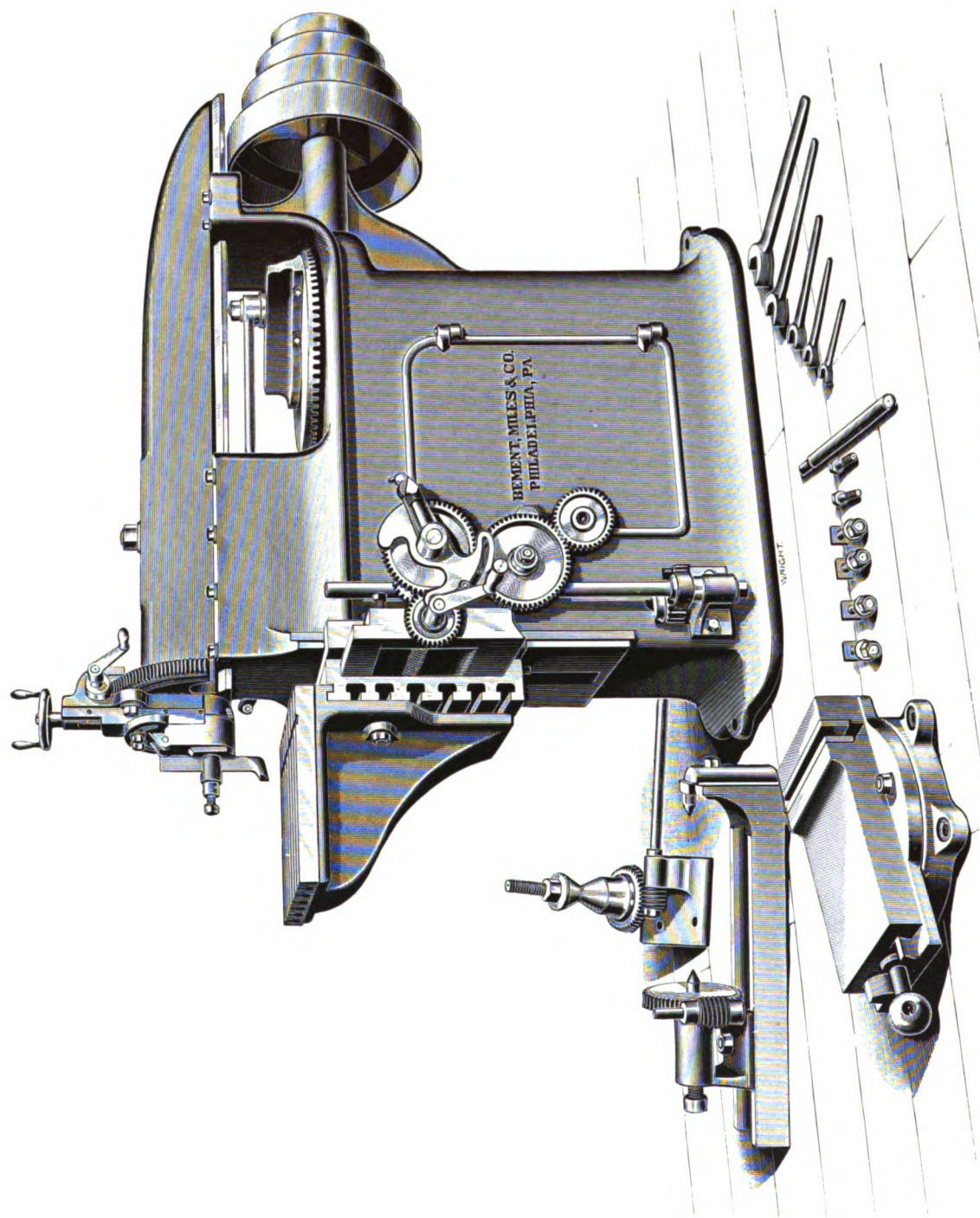


10-INCH SHAPING MACHINE.

10-INCH SHAPING MACHINE,

WITH TRAVELLING TABLE.

Cutting bar has four speeds and quick return motion. Stroke, $10\frac{1}{4}$ inches, with adjustment for any position and length of movement. Tool slide swivels to any angle from vertical to horizontal and has a movement of $5\frac{1}{2}$ inches. Positive feed, variable and self-acting in either direction. Table has 18 inches horizontal traverse and 14 inches vertical adjustment. Includes a clamping vise, a pair of centres, a self-feeding cone arbor for circular work, countershaft and wrenches.



16-INCH SHAPING MACHINE, WITH TRAVELLING TABLE.

16-INCH SHAPING MACHINE,

WITH TRAVELLING TABLE.

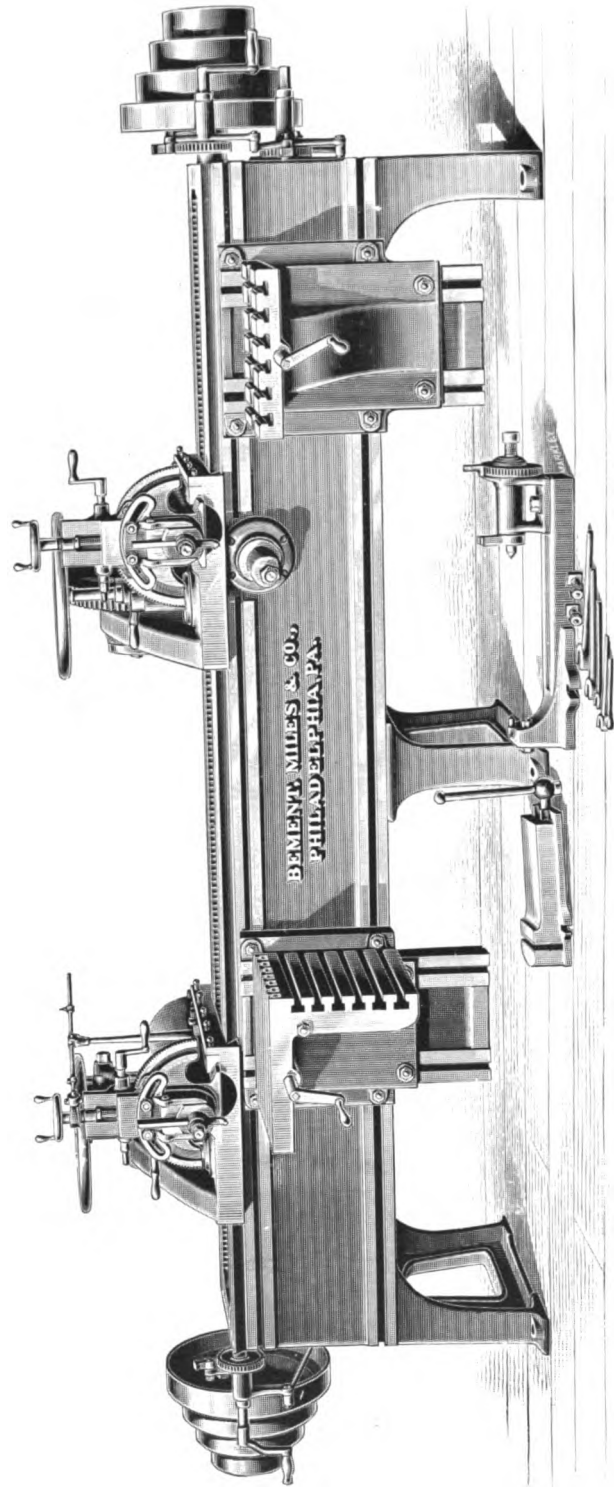
Cutting bar has eight speeds and quick return motion. Stroke, $16\frac{1}{2}$ inches, with adjustment for any position and length of movement. Tool slide swivels to any angle from vertical to horizontal and has a movement of 7 inches. Positive feed variable and self-acting in either direction. Table has 24 inches horizontal traverse and 17 inches vertical adjustment. Includes a clamping vise, pair of centres, self-feeding cone arbor for circular work, countershaft and wrenches.

12-INCH SHAPING MACHINE,

WITH TRAVELLING HEAD.

Cutting bar has four speeds and quick return motion. Stroke, $12\frac{1}{2}$ inches, with adjustment for any position and length of movement. Tool slide swivels to any angle from vertical to horizontal and has a movement of 6 inches. Positive feed, variable and self-acting in either direction. Saddle carrying cutting bar has a traverse on bed of 44 inches. Two tables with longitudinal and vertical adjustment, one arranged with both horizontal and vertical surfaces for holding work. Includes a clamping vise, pair of centres, self-feeding cone arbor for circular work, countershaft and wrenches.

The above is sometimes built as a double 12-inch shaper in the same manner as the 16-inch and 18-inch.



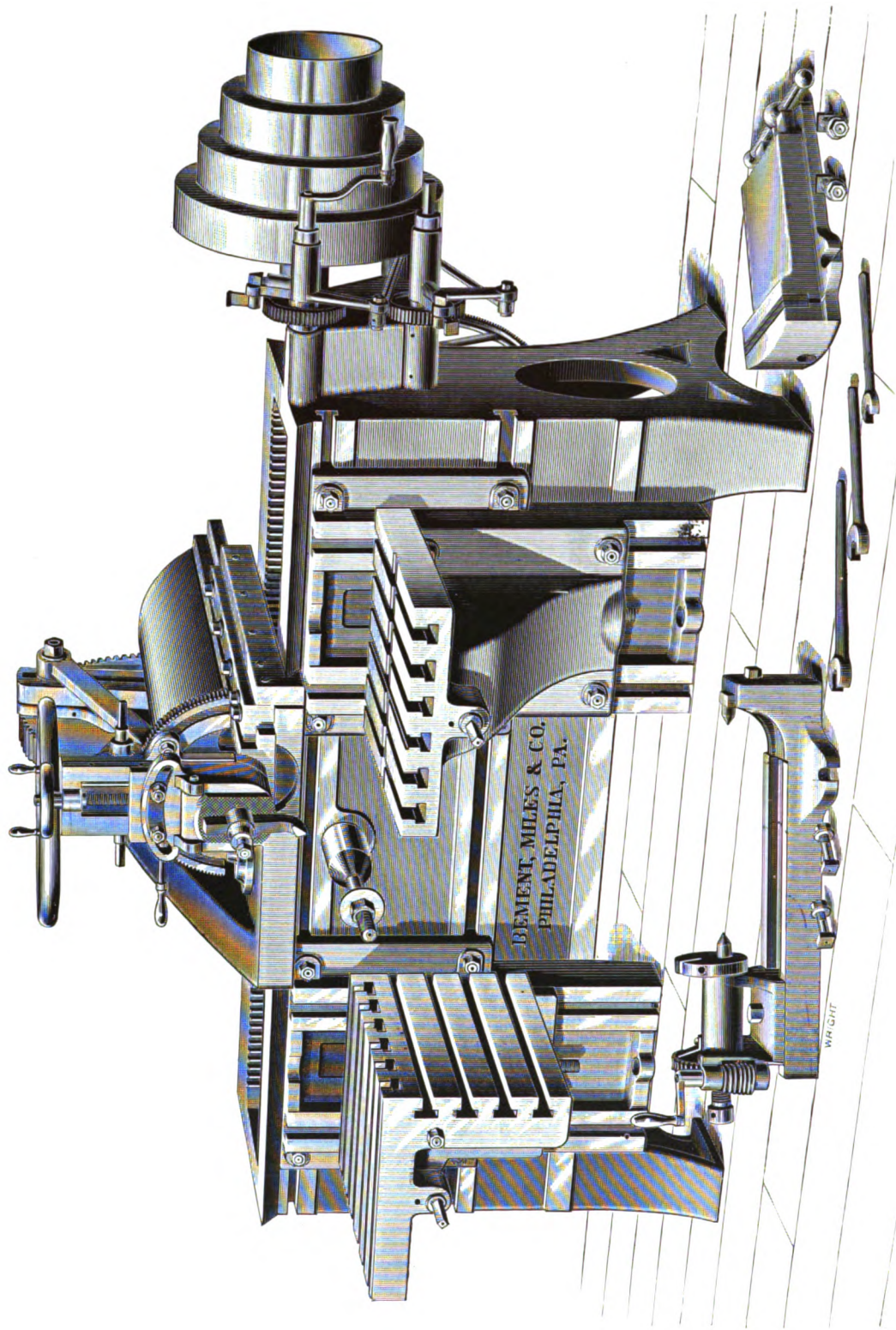
DOUBLE 16-INCH SHAPING MACHINE, WITH TRAVELLING HEADS.

16-INCH SHAPING MACHINE, WITH TRAVELLING HEAD.

Cutting bar has eight speeds and quick return motion. Stroke, 17 inches, with adjustment for any position and length of movement. Tool slide swivels to any angle from a vertical to a horizontal position, and has a movement of 7 inches. Positive feeds, variable and self-acting in either direction. Saddle carrying cutting bar has a longitudinal traverse of 54 inches by screw, and a rapid hand movement by hand wheel connected with rack on bed. Two tables with longitudinal and vertical adjustment, one arranged with both horizontal and vertical surfaces for holding work. Includes a clamping vise, pair of centres, self-feeding cone arbor, countershaft and wrenches.

DOUBLE 16-INCH SHAPING MACHINE, WITH TRAVELLING HEADS.

Consist of two complete and entirely independent machines upon one bed, capable of being used separately, or together. Bed is made of any length from 8 feet to 20 feet. Cutting bars have eight speeds and quick return motion. Stroke, 17 inches, with adjustment for any position and length of movement. Tool slides swivel to any angle from vertical to horizontal, and have a movement of 7 inches. Positive feed, variable and self-acting in all directions; hand movement of saddles on bed by screw, also rapid traverse by hand wheel communicating with rack. Two tables with longitudinal and vertical adjustment, one with both horizontal and vertical surfaces for holding work. Includes a clamping vise, pair of centres, self-feeding cone arbor, countershaft and wrenches. If desired, the machine will be furnished without the centres and cone arbor.



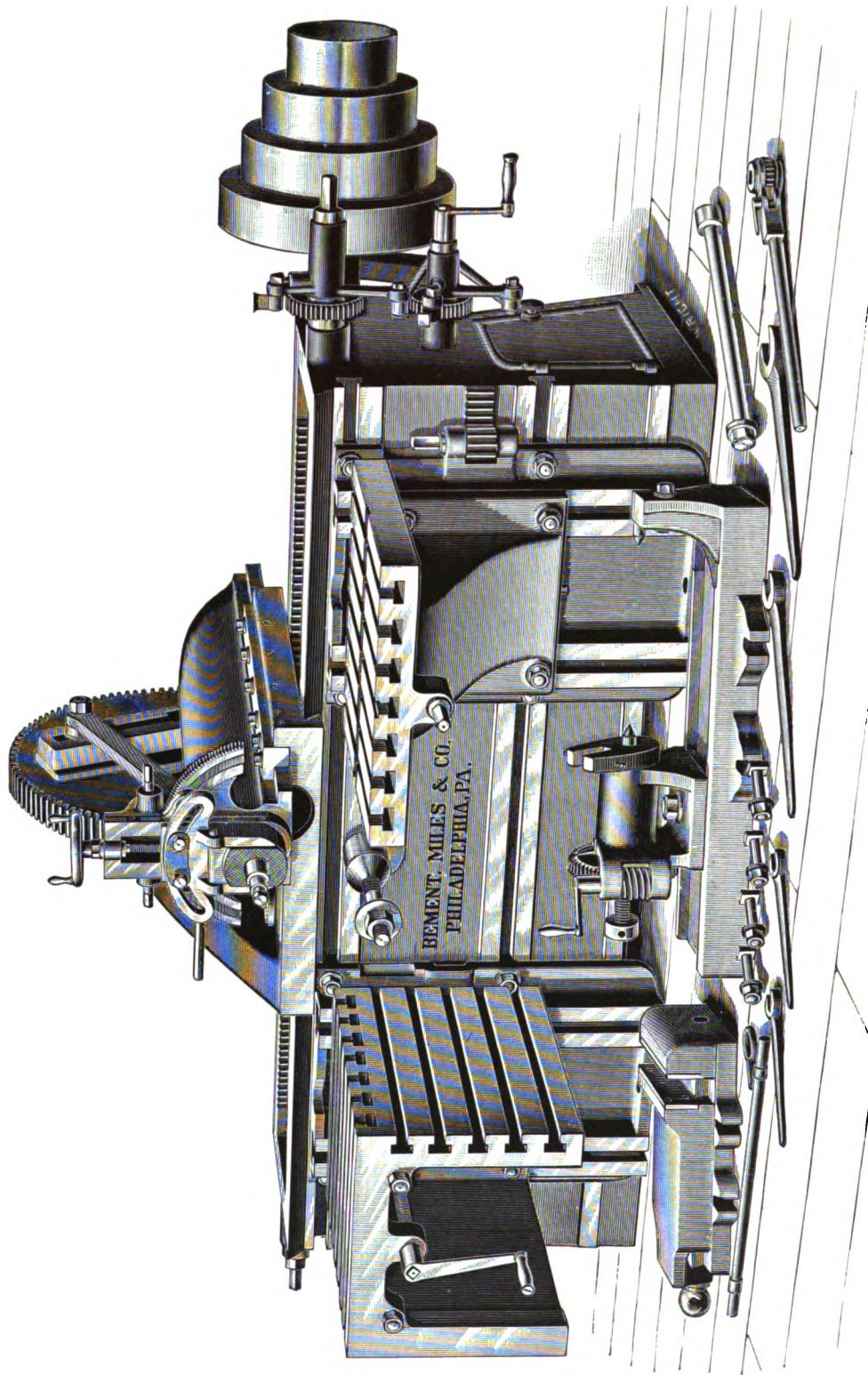
18-INCH SHAPING MACHINE, WITH TRAVELLING HEAD.

18-INCH SHAPING MACHINE, WITH TRAVELLING HEAD.

Cutting bar has eight speeds and quick return motion. Stroke, 19 inches, with adjustment for any position and length of movement. Tool slide swivels to any angle from a vertical to a horizontal position, and has a movement of 7 inches. Positive feed variable and self-acting in either direction. Saddle carrying cutting bar has a longitudinal traverse of 60 inches by screw, and a quick hand movement by hand wheel connected with rack on bed. Two tables with longitudinal and vertical adjustment, one arranged with both vertical and horizontal surface for holding work. Includes a clamping vise, pair of centres, self-feeding cone arbor, countershaft and wrenches.

DOUBLE 18-INCH SHAPING MACHINE, WITH TRAVELLING HEADS.

Consists of two complete and entirely independent machines upon one bed, capable of being used separately, or together. Bed can be made of any length from 8 feet to 20 feet. Cutting bars have eight speeds and quick return motion. Stroke, 19 inches, with adjustment for any position and length of movement. Tool slides swivel to any angle from vertical to horizontal, and have a movement of 7 inches. Positive feed variable and self-acting in all directions; hand movement of saddles on bed by screw, also rapid traverse by hand wheel communicating with rack. Two tables with longitudinal and vertical adjustment, one with both horizontal and vertical surfaces for holding work. Includes a clamping vise, pair of centres, self-feeding cone arbor, countershaft and wrenches. If desired, the machine will be furnished without the centres and cone arbor.

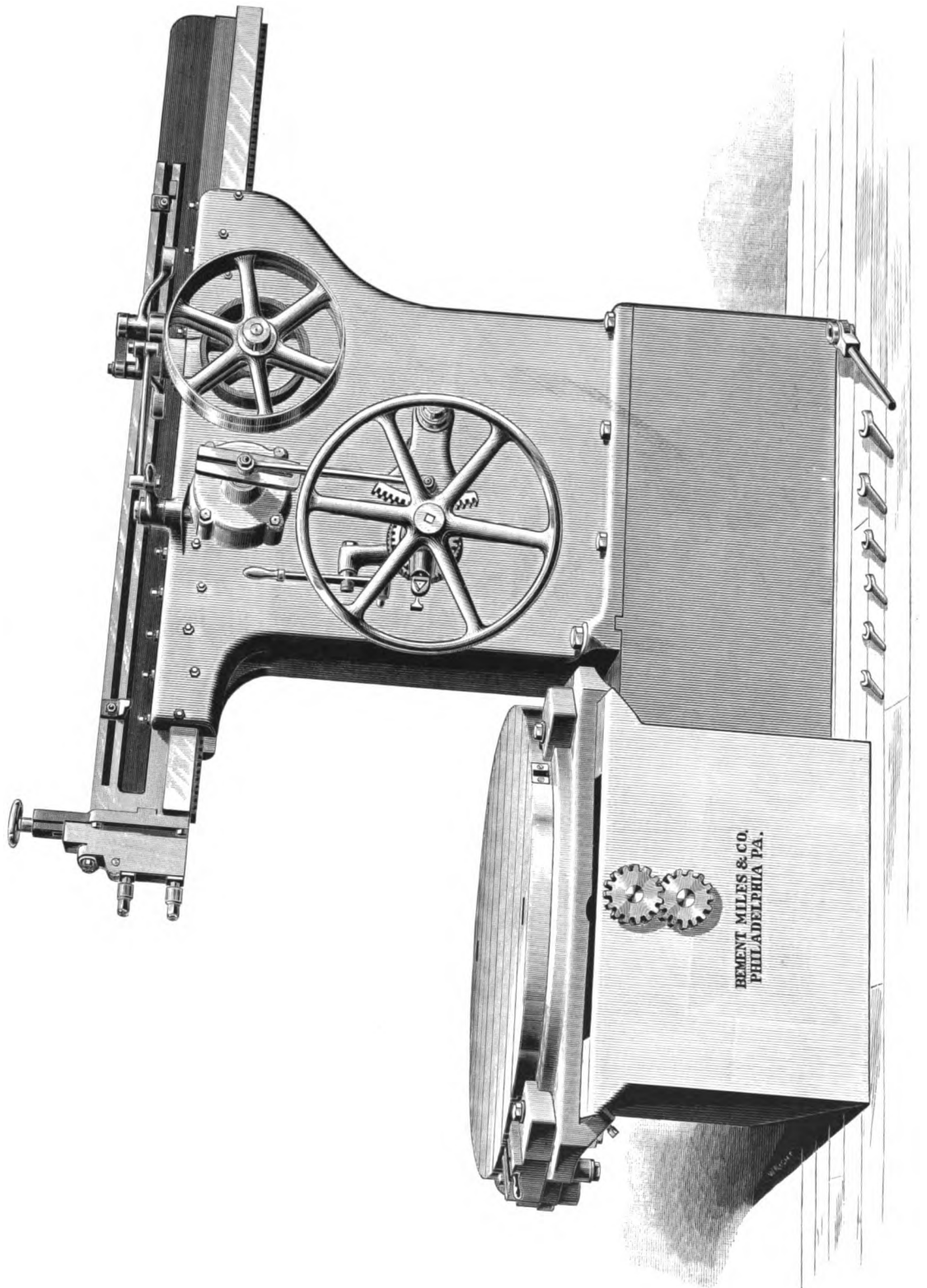


24-INCH SHAPING MACHINE, WITH TRAVELLING HEAD.

24-INCH SHAPING MACHINE,

WITH TRAVELLING HEAD.

Cutting bar has eight speeds and quick return motion. Stroke, 26 inches, with adjustment for any position and length of movement. Tool slide swivels to any angle and has a movement of 8 inches. Positive feed, variable and self-acting in either direction, as well as for internal and external curves. Saddle carrying cutting bar has a longitudinal traverse of 72 inches by screw, and a rapid hand movement by hand wheel connected with rack on bed. Two tables with longitudinal and vertical adjustment, one arranged with both horizontal and vertical surfaces for holding work. Includes vise, pair of centres, self-feeding cone arbor for circular work, countershaft and wrenches.

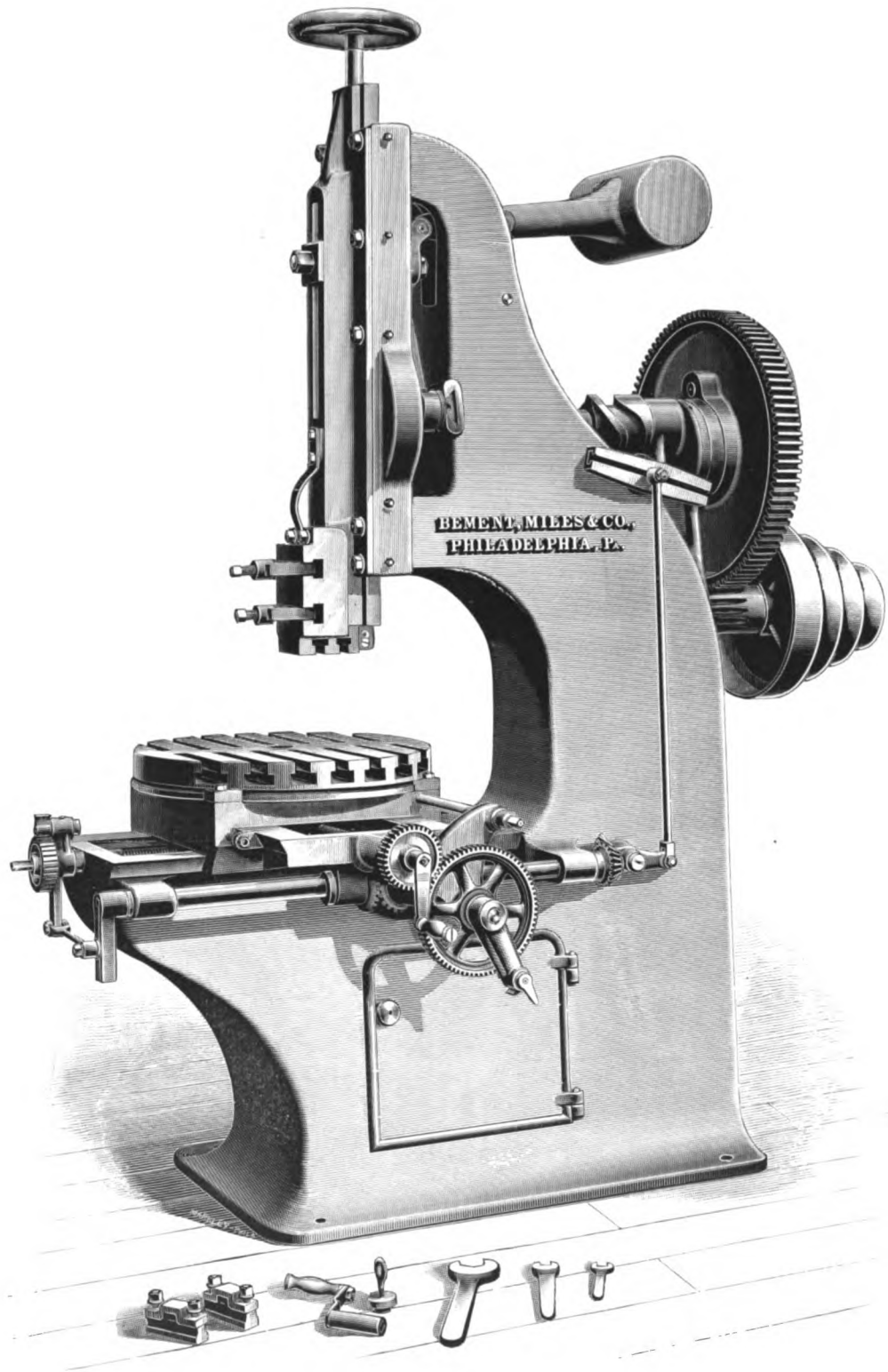


BEMENT MILES & CO.
PHILADELPHIA PA.

CYLINDER SHAPING MACHINE.

CYLINDER SHAPING MACHINE.

For planing the valve and steam chest seats of locomotive cylinders. Stroke of cutting bar, 42 inches, with quick return (at four times the forward speed), and adjustment for any position and length of movement; reverse movements of same by two belts separately shifted. The table, which is 54 inches in diameter, has a variable self-acting transverse feed through a distance of 34 inches, operated directly from driving works, and quick return by power or hand; also a ready means of adjustment to the right angled positions required for planing the steam chest seats. Distance from lower side of cutting bar to table, 36 inches, and from centre of table to inside of frame, 30 inches. All the movements are controlled from one position convenient to the workman. Countershaft and wrenches included.



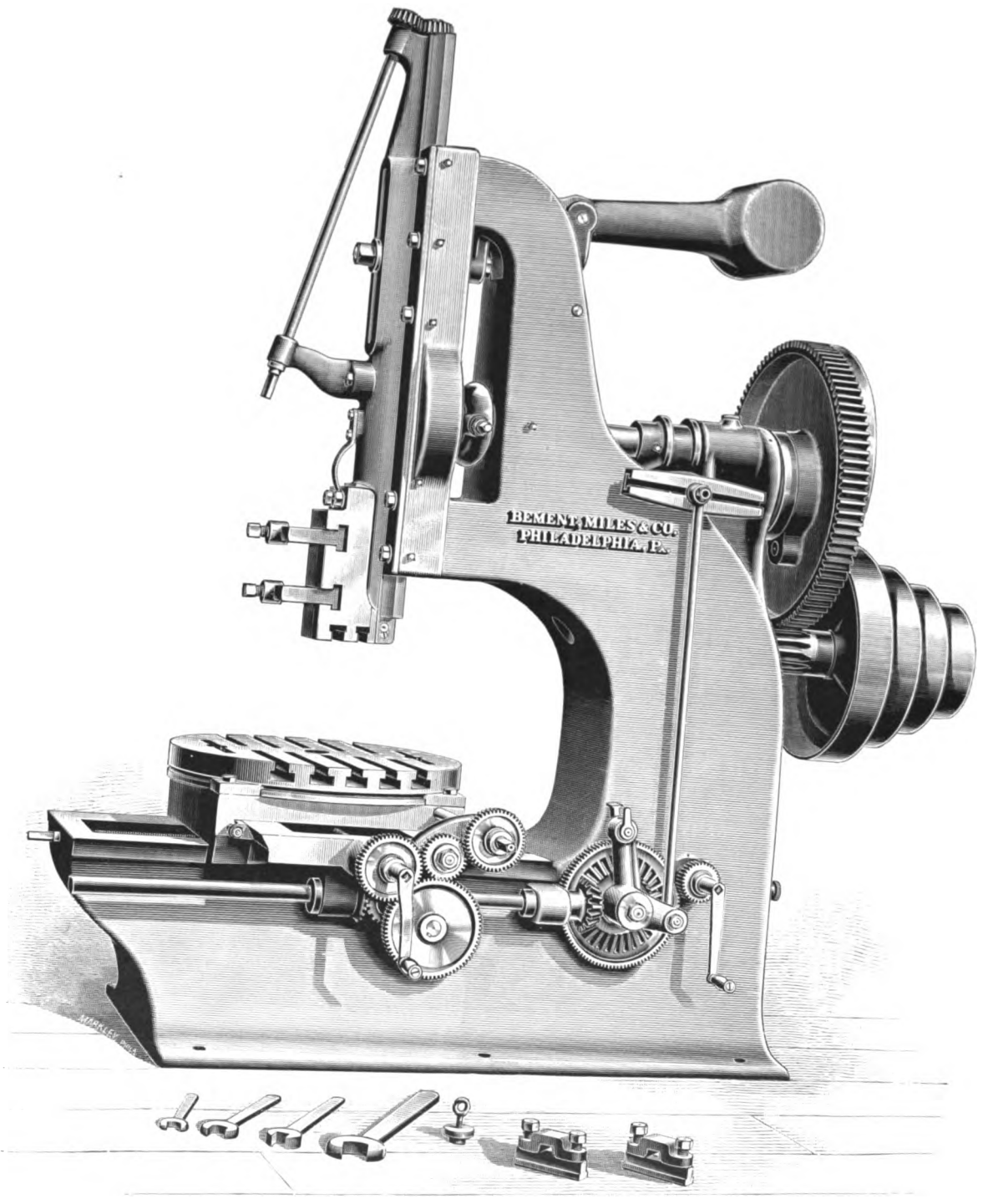
10-INCH SLOTTING MACHINE.

6-INCH SLOTTING MACHINE.

Cutting bar has three speeds, with counterbalance and quick return motion. Stroke, $6\frac{1}{4}$ inches, with adjustment for any position and length of movement. Feeds positive by variable cam, self-acting in all directions, and operating at upper end of stroke. Distance from front of cutting bar to inside of frame, 11 inches. Compound tables have an adjustment of 10 inches longitudinally and 17 inches transversely; and support a revolving table 18 inches in diameter, which may be fixed in position by corner clamps when circular feeds are not in use. Tool closet in frame, countershaft and wrenches included.

10-INCH SLOTTING MACHINE.

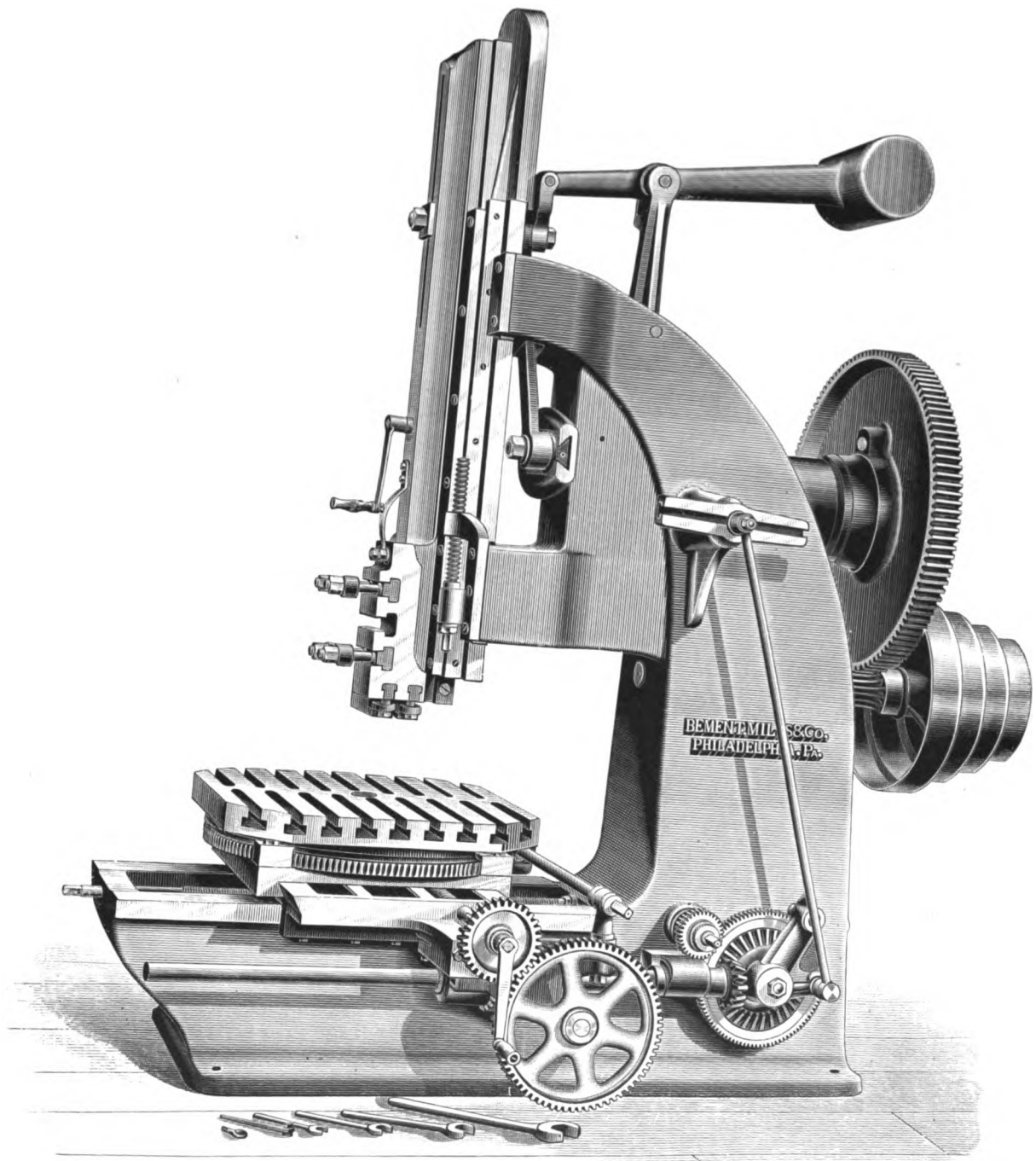
Cutting bar has four speeds, with counterbalance, quick return motion and relief tool apron. Stroke, $10\frac{1}{2}$ inches, with adjustment for any position and length of movement. Feeds positive, by variable cam, self-acting in all directions, and operating at upper end of stroke. Distance from front of cutting bar to inside of frame, $20\frac{1}{4}$ inches. Compound tables have an adjustment 17 inches longitudinally and 24 inches transversely, and support a revolving table 24 inches in diameter, which may be fixed in position by corner clamps when circular feeds are not in use. Tool closet in frame, countershaft and wrenches included.



13-INCH SLOTTING MACHINE.

13-INCH SLOTTING MACHINE.

Cutting bar has eight speeds, with counterbalance, quick return motion and relief tool apron. Stroke, $13\frac{1}{2}$ inches, with adjustment for any position and length of movement. Feeds positive, by variable cam, self-acting in all directions, operating at upper end of stroke, and so arranged as to be controlled by the workman from one position. Distance from front of cutting bar to inside of frame, $30\frac{1}{4}$ inches. Compound tables have an adjustment of 37 inches longitudinally and 30 inches transversely, and support a revolving table 30 inches in diameter, which may be fixed in position by corner clamps when circular feeds are not in use. Tool closet in frame. Countershaft and wrenches included.



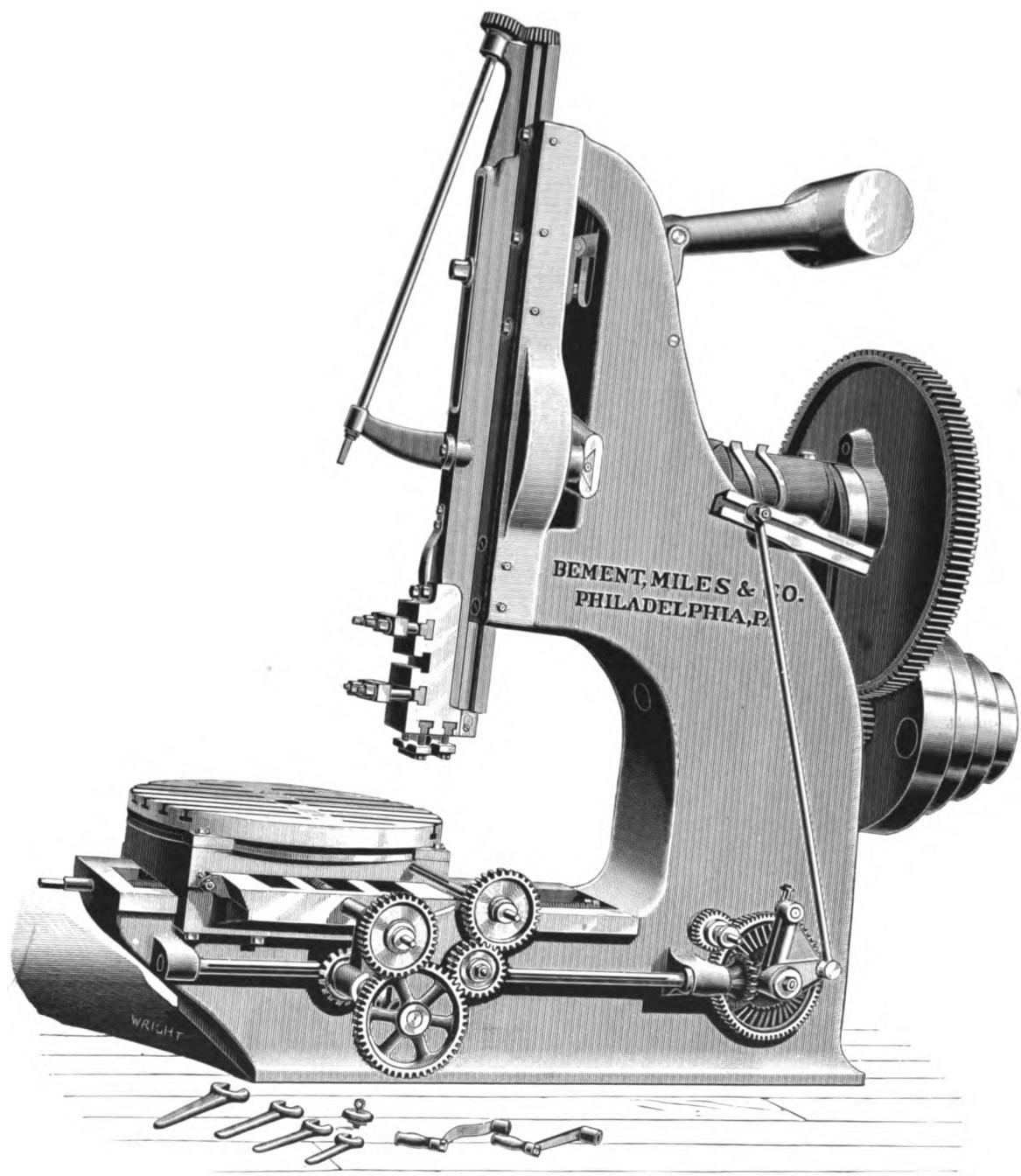
16-INCH SLOTING MACHINE.

16-INCH SLOTTING MACHINE.

Stroke, $16\frac{1}{2}$ inches, with adjustment for any position and length of movement. Cutting bar has eight speeds, with counterbalance, quick return motion, and tool lifting apron. It is also provided with a reinforcing guide, vertically adjustable by screw to suit the work. Feeds positive and variable by cam, self-acting in all directions, operating at upper end of stroke, and so arranged that all can be controlled by the workman from one position. Distance from front of cutting bar to inside of frame, 34 inches, affording space for the key-seating of a 76-inch wheel. Compound tables have an adjustment of 41 inches longitudinally, by 32 inches transversely, and support a revolving rectangular table 36 inches in diameter, or 43 inches across the corners, which may be fixed in position by corner clamps when circular feeds are not in use. When so ordered, the tool lifter may be made to work automatically for any stroke or position of cutting bar. Countershaft, wrenches, etc., included.

18-INCH SLOTTING MACHINE.

Stroke, $18\frac{1}{2}$ inches. Cutting bar has eight speeds, with counterbalance, quick return motion, and tool lifting apron, which may be made to work automatically for any stroke, or position of bar, if so ordered. It is also provided with a reinforcing guide, vertically adjustable by screw to suit the work. Feeds positive and variable by cam, self-acting in all directions, operating at upper end of stroke, and so arranged that all can be controlled by the workman from one position. Distance from front of cutting bar to inside of frame, 36 inches, affording space for the key-seating of an 80-inch wheel. Compound tables have an adjustment of 48 inches longitudinally, by $41\frac{1}{2}$ inches transversely, and support a revolving rectangular table 40 inches in diameter, or 48 inches across the corners, which may be fixed in position by corner clamps when circular feeds are not in use. When desired, the tool lifter can be disengaged, and the apron screwed firmly to the cutting bar. Countershaft, wrenches, etc., included.

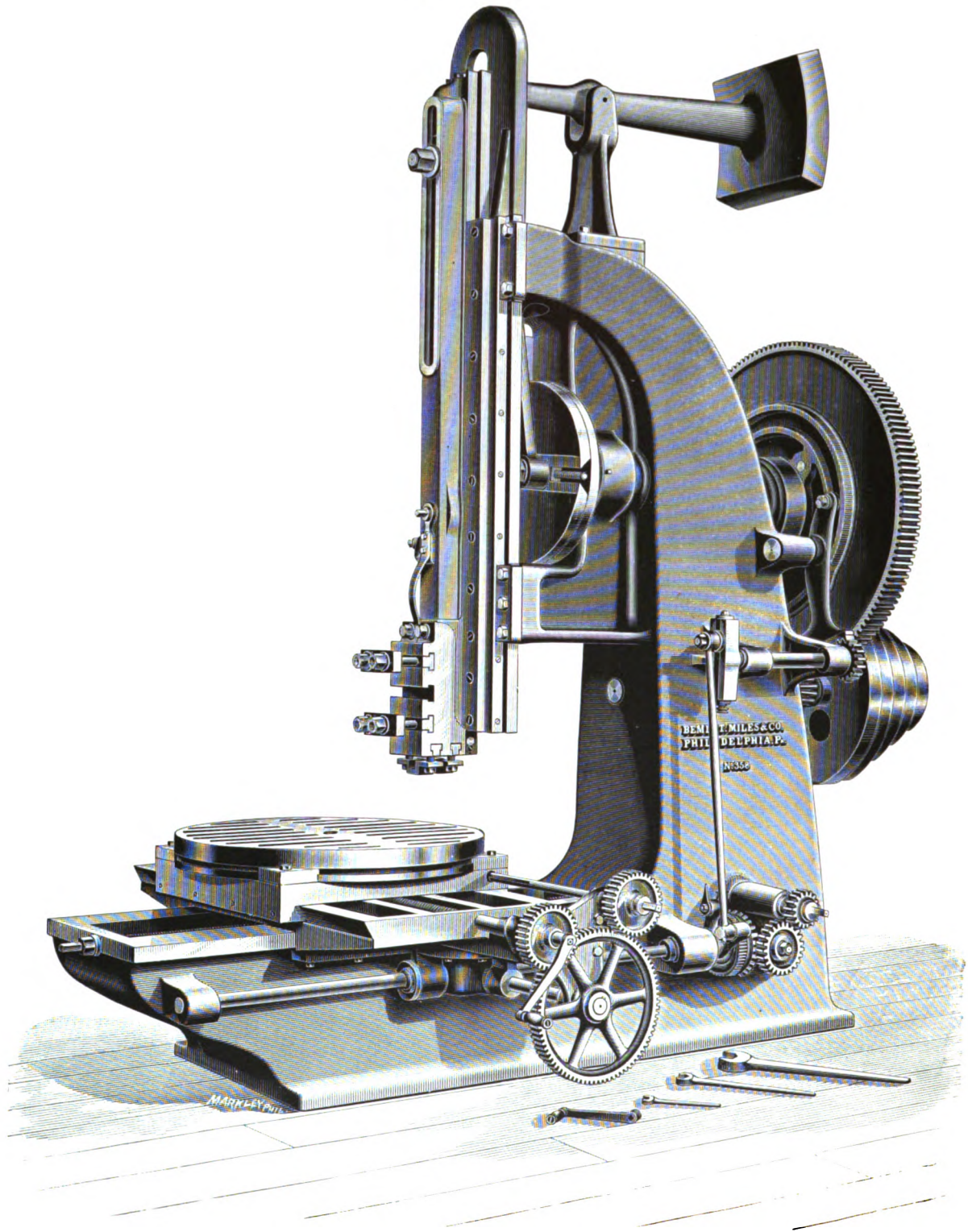


21-INCH SLOTTING MACHINE.

21-INCH SLOTTING MACHINE.

Cutting bar has eight speeds, with counterbalance, quick return motion and relief tool apron. Stroke, $21\frac{1}{2}$ inches, with adjustment for any position and length of movement. Feeds positive, by variable cam, self-acting in all directions, operating at upper end of stroke, and so arranged that all can be controlled by the workman from one position. Distance from front of cutting bar to inside of frame, $41\frac{1}{2}$ inches. Compound tables have an adjustment of 54 inches longitudinally, and 44 inches transversely; and support a revolving table 44 inches in diameter, which may be fixed in position by corner clamps when circular feeds are not in use. Tool closet in frame. Countershaft and wrenches included.

If desired, this machine will be built with a rectangular table, 54 inches across the corners.



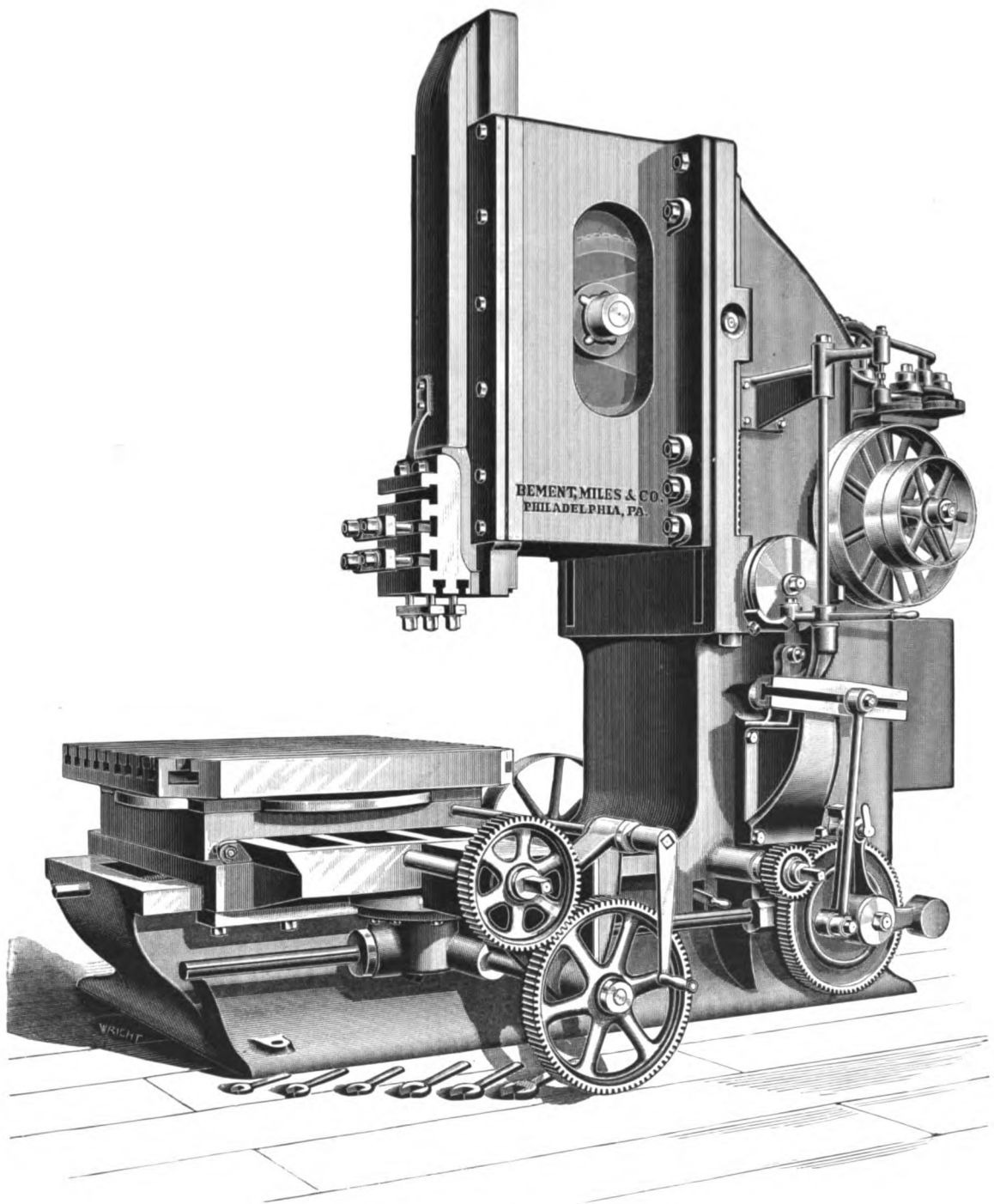
24-INCH SLOTTING MACHINE.

24-INCH SLOTTING MACHINE.

Stroke, 24½ inches, with adjustment for any position and length of movement. Cutting bar has eight speeds, with counterbalance, quick return motion, and a tool relief apron, which may be made automatic, if so ordered. It is also provided with a reinforcing guide vertically adjustable to suit the work. Feeds positive by variable cam, self-acting in all directions, operating at upper end of stroke, and so arranged that all can be controlled by the workman from one position. Distance from front of cutting bar to inside of frame, 43 inches, affording space for the key-seating of a 96-inch wheel. Compound tables have an adjustment of 60 inches longitudinally, and 48 inches transversely; and support a revolving rectangular table 50 inches in diameter, or 62 inches across the corners, which may be fixed in position by corner clamps, when circular feeds are not in use. Countershaft and wrenches included.

30-INCH SLOTTING MACHINE.

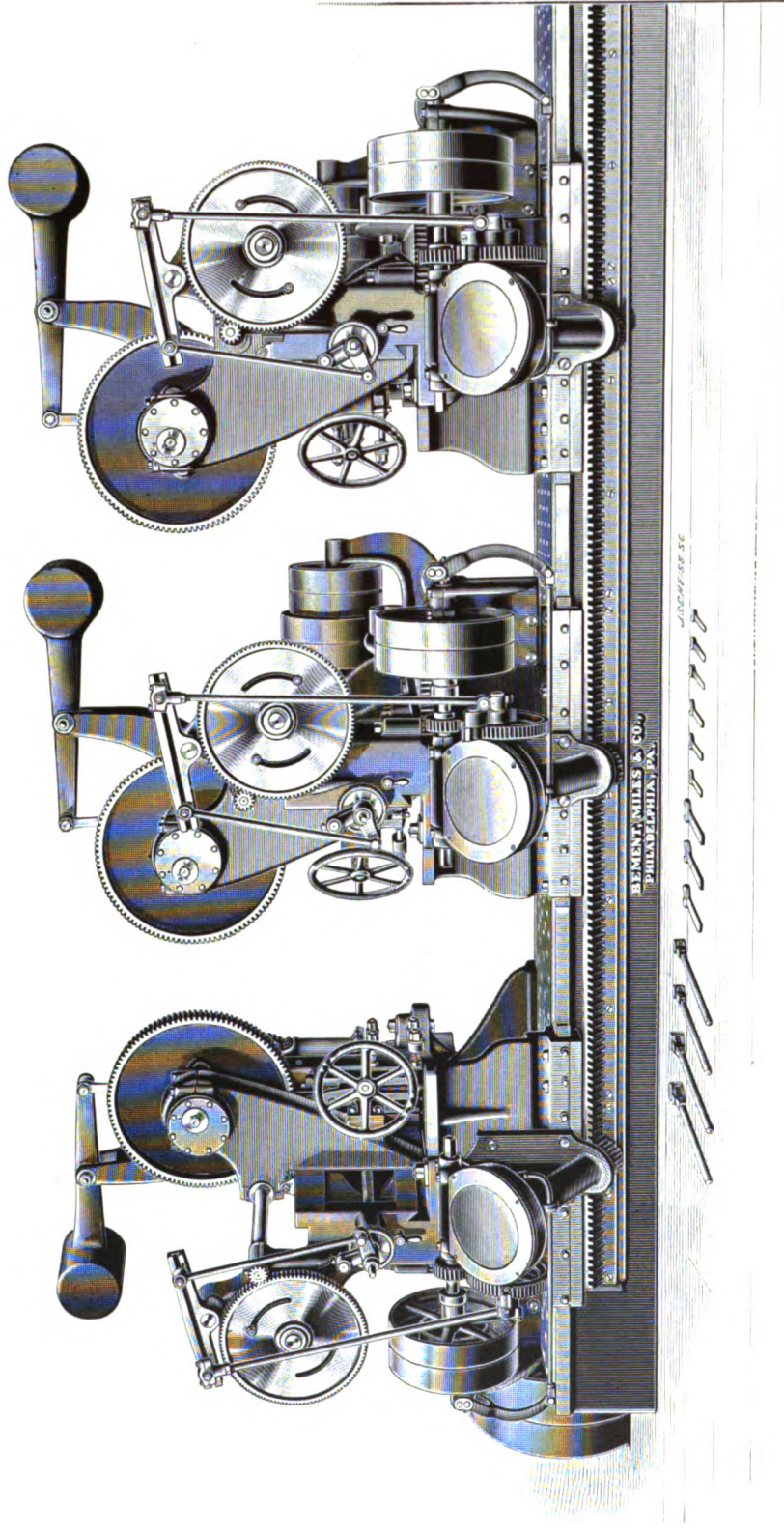
Stroke, 31 inches, with adjustment for any position and length of movement. Cutting bar has ten speeds, with counterbalance, quick return motion, and a tool relief apron, which may be made automatic, if so ordered. It is also provided with a reinforcing guide vertically adjustable to suit the work. Feeds positive by variable cam, self-acting in all directions, operating at upper end of stroke, and so arranged that all can be controlled by the workman from one position. Distance from front of cutting bar to inside of frame, about 47 inches. Compound tables have an adjustment of 66 inches longitudinally, and 60 inches transversely; and support a revolving rectangular table 54 inches in diameter, or 68 inches across the corners, which may be fixed in position by corner clamps, when circular feeds are not in use. Countershaft and wrenches included.



48-INCH SLOTTING MACHINE.

48-INCH SLOTTING MACHINE.

Driven by two belts, separately shifted, through a train of cut gearing to a steel rack on cutting bar, giving a variable stroke up to 54 inches. Distance from inside of frame to front side of cutting bar, $43\frac{3}{4}$ inches. Cutting speed uniform, with a return motion of three to one. Cutting bar has a tool-lifting apron, which will be made automatic, if so ordered, is balanced; and, on account of its long projection, is supported in a movable bearing. Feeds positive, variable and self-acting in all directions, operating at upper end of stroke. The adjustment of cutting bar, length of stroke and the feed can be conveniently regulated from the position of the workman. Compound tables have an adjustment of 60 inches longitudinally and 60 inches transversely; and support a revolving table of rectangular shape 54 inches square, or 68 inches across the corners, which may be fixed in position by corner clamps when circular feed is not in use. This form of table gives a greater clamping surface than a circular one, without diminishing the traverses. The tables also have a rapid power movement, in either direction, from a separate countershaft. Includes countershaft and wrenches.



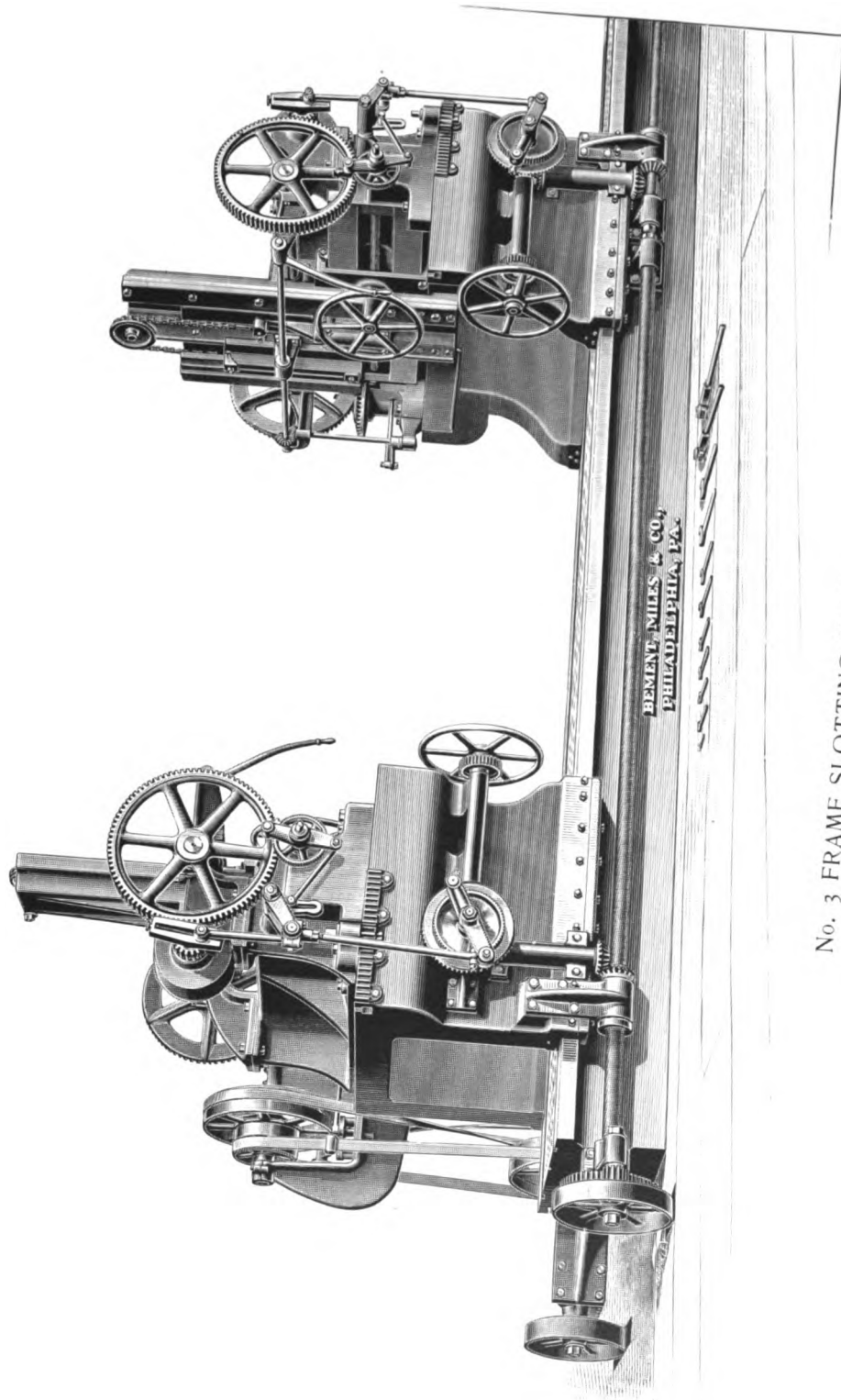
No. 2 TRIPLE LOCOMOTIVE FRAME SLOTTING MACHINE.

No. 1 DOUBLE LOCOMOTIVE FRAME SLOTING MACHINE.

Has two opposite heads traversing on a bed from 30 feet to 38 feet, as may be required. Each head is independently driven, with two speeds. Greatest stroke, 21 inches, with quick return motion and balanced cutting bars. Longitudinal and cross feeds independent and variable automatically by cam, operating at upper end of stroke. Cross slide can be set at an angle in either direction from a transverse line equal to $1\frac{1}{8}$ inches in 10 inches. Area of saddle in the clear, $34\frac{3}{4}$ inches crosswise and 23 inches vertically. Rapid traverse of head on cross slides by hand wheel, etc., and rapid movement of saddles on bed by power. All motions are controlled from one point most convenient to the workman.

No. 2 TRIPLE LOCOMOTIVE FRAME SLOTING MACHINE.

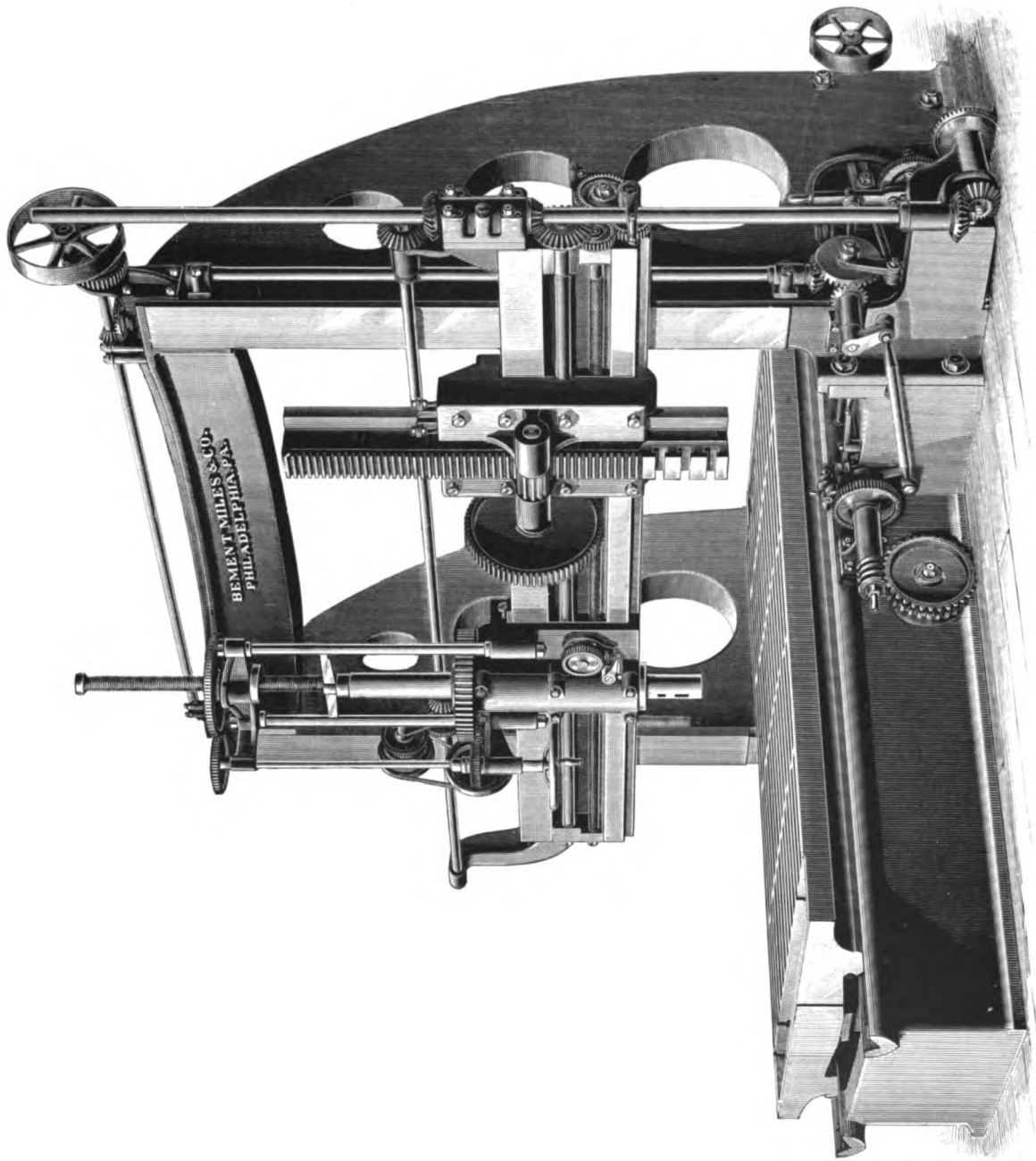
Has three heads, two in opposite positions, traversing on a bed from 36 feet to 42 feet long, as may be required. Each head is independently driven, with two speeds. Greatest stroke, 21 inches, with quick return motion and balanced cutting bars. Longitudinal and cross feeds independent and variable automatically by cam operating at upper end of stroke. Cross slide can be set at an angle in either direction from a transverse line equal to $1\frac{1}{8}$ inches in 10 inches. Area of saddle in the clear, $34\frac{3}{4}$ inches crosswise and 23 inches vertically. Rapid hand movement of head on cross slide by hand wheel, etc., and rapid traverse of saddles on bed by power. All the movements are controlled from one position most convenient to the operator.



No. 3 FRAME SLOTTING MACHINE.

No. 3 FRAME SLOTTING MACHINE.

Capable of slotting eight frames at one setting. Has two opposite independent heads traversing on a bed from 36 to 44 feet long, as may be ordered. Area of saddles in the clear, 44 inches in width by 36 inches in height. Each saddle is driven by two belts through reversing pulleys and a train of gearing, to a rack on a counterbalanced cutting bar. These bars have an extreme stroke of 38 inches, and a return motion of three times the cutting speed. Feeds automatic, variable and independent in all directions, operating at upper end of stroke. Rapid traverse of heads on cross slides by hand wheel, rack and pinion; and rapid movement of saddles along the bed by power from a separate countershaft. Cross slides can be set at an angle, in either direction from a transverse line, equal to $1\frac{1}{4}$ inches in 12 inches. Countershafts and wrenches included.



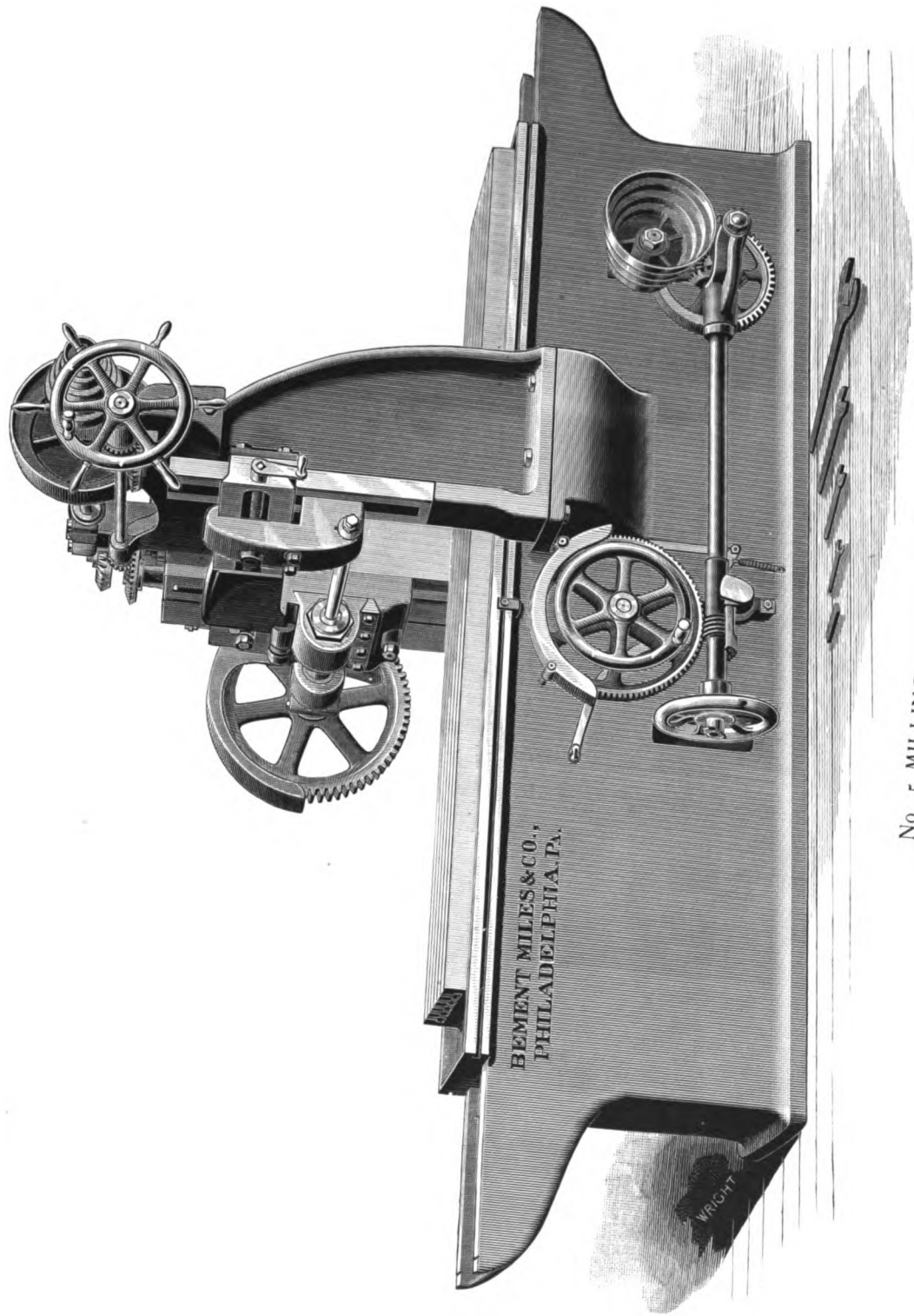
COMBINED BORING AND SLOTTING MACHINE.



COMBINED BORING AND SLOTTING MACHINE.

Width between uprights, 122 inches, and height under cross slide, 84 inches. Usual length of table, 10 feet, which may be made longer or shorter. Boring spindle has a traverse of 36 inches, with four changes of automatic feed, and hand adjustment vertically and horizontally. The slotting bar has a movement of 48 inches, with counterbalance and rapid return motion, also variable feeds, both longitudinally up to $\frac{3}{4}$ inch by the table, and transversely along the cross slide. In addition to the feeds, the table has a rapid power movement of 15 feet. The cross slide is raised and lowered by power. Countershaft and wrenches included.

Milling Machines, Upright, Radial, Horizontal and other Drilling
Machines,
Upright Boring and Turning Machines.



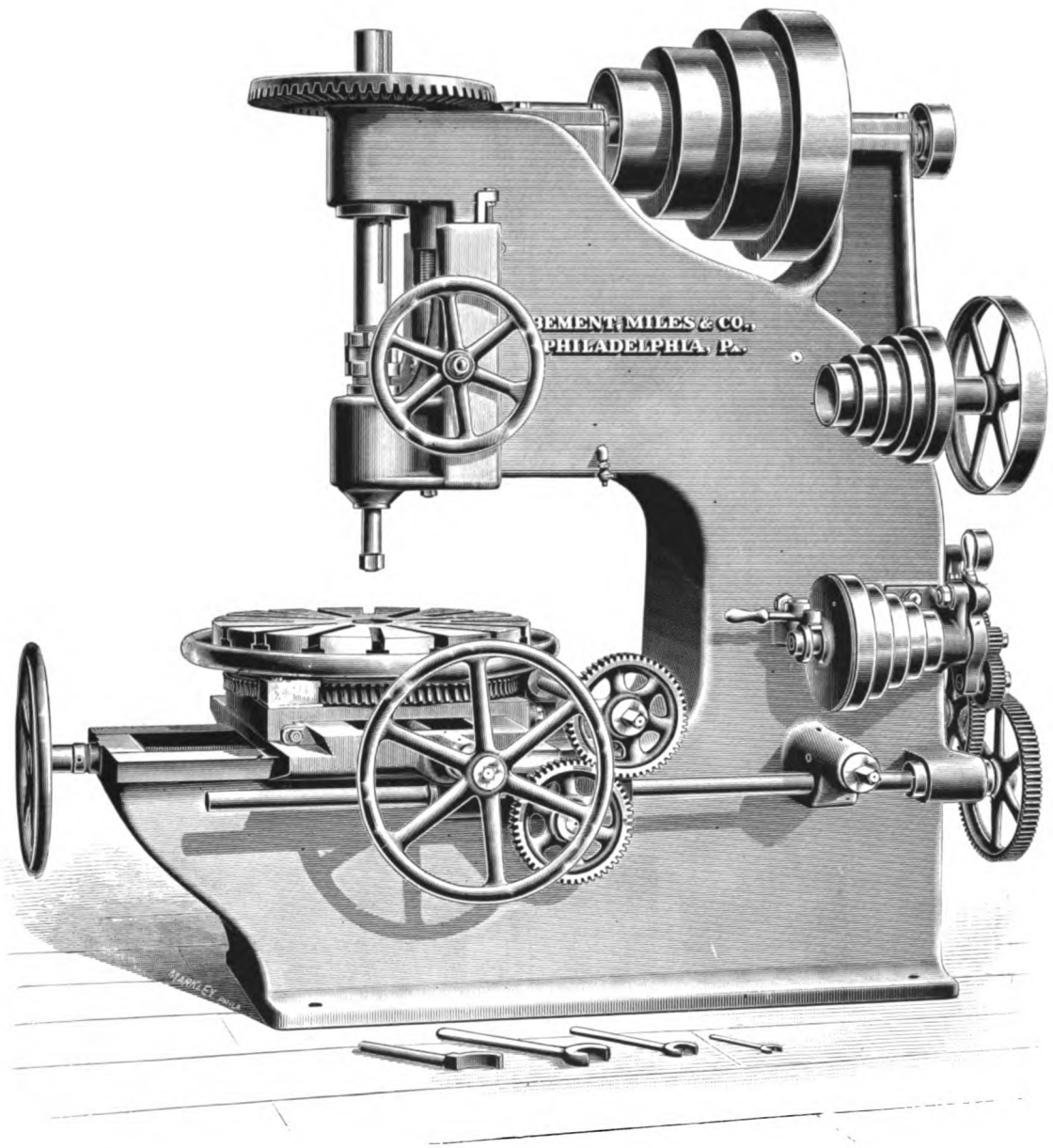
No 5 MILLING MACHINE.

No. 4 MILLING MACHINE.

Has three driving motions by cone and gearing, and three changes of feed, the table stopping automatically at any required point. Longitudinal traverse of table is 24 inches, lateral adjustment 9 inches, and vertical movement of saddle $9\frac{1}{2}$ inches. Includes countershaft, an extra support for outer end of saddle arm for heavy work, a clamping vise and pair of index centres.

No. 5 MILLING MACHINE.

For large work and heavy cuts. Has six changes of speed and is geared three times to spindle, which has a provision for wear and is supported in a slide having an end adjustment by screw. Spindle can be raised 18 inches above table and will work a cutter 10 inches in diameter. Outer bearing for cutter arbor is movable transversely, raises and lowers with spindle and has a post for rigid support, which can be removed for facing, or cross cutting, on ends of long work. Space between uprights, 22 inches; upper surface of table, 16 inches wide and of any required length. Table has five self-acting feeds, automatic stop motion and quick hand movement by rack and pinion. The above may be built with two opposite main posts separately driven, forming a double machine. Countershaft and wrenches included. The machine will also be furnished with a clamping vise and index centres, if so ordered.



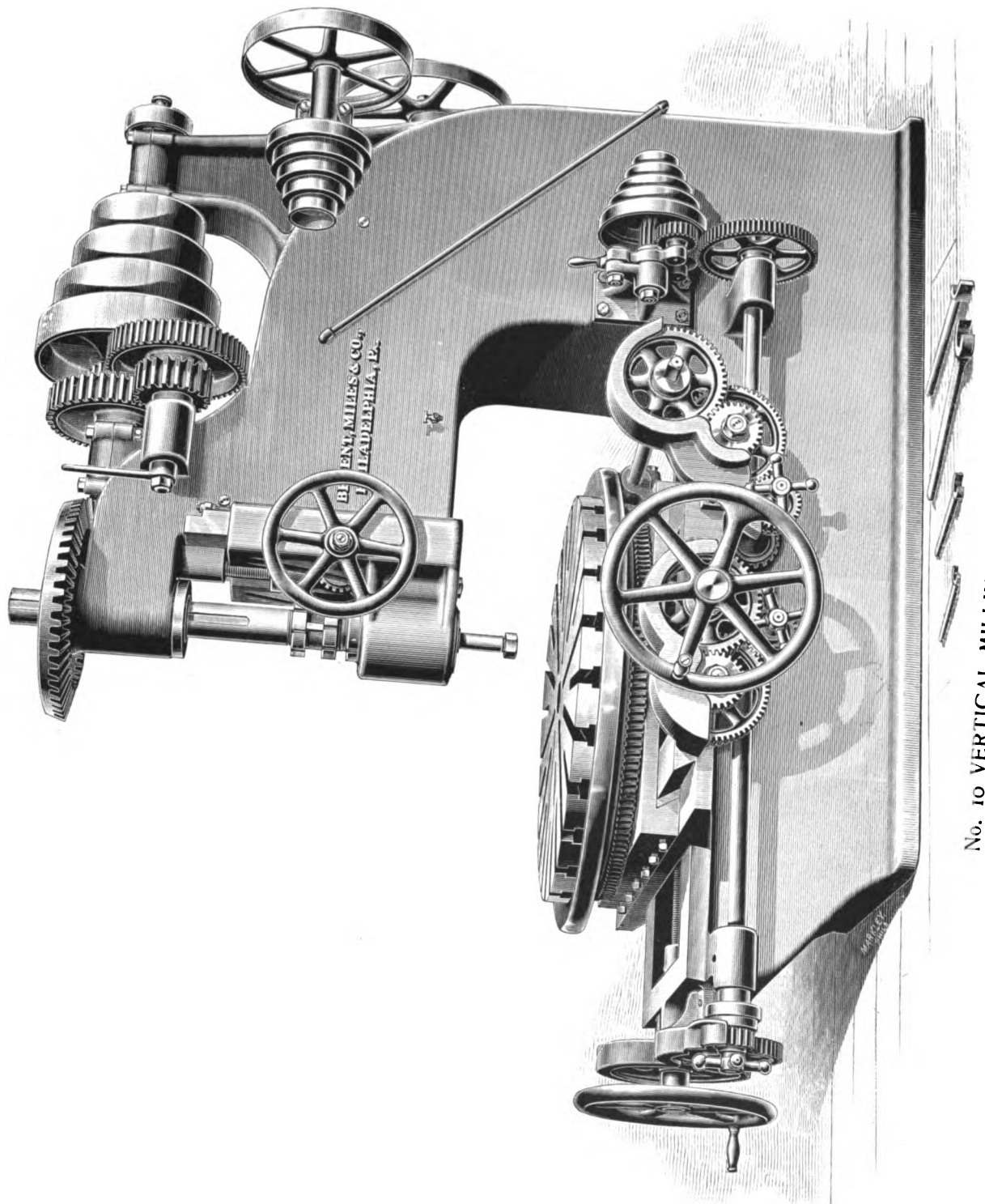
No. 9 VERTICAL MILLING MACHINE.

No. 7 MILLING MACHINE.

For axles or shafts up to 10 inches diameter, and of any length. Has four speeds by large cone powerfully geared, three changes of automatic feed, operating either throughout the entire movement of table, or any part of it, and rapid hand movement by rack and pinion. Cutter spindle is adjustable laterally as well as vertically. Bed and table can be made of any desired length. Feed gearing, quick return and all the adjustments are readily controllable from one position. Countershafts, wrenches, etc., included.

No. 9 VERTICAL MILLING MACHINE.

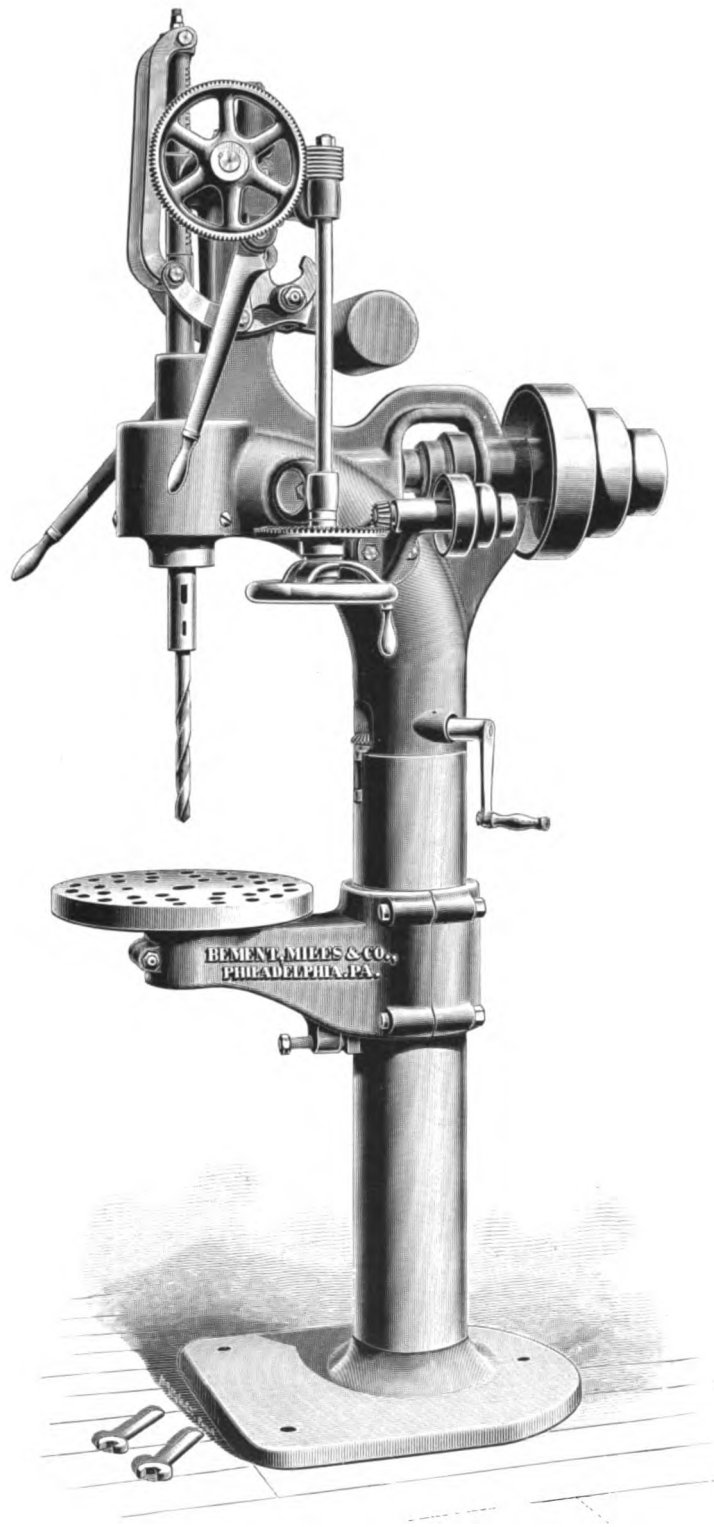
Has four changes of speed, and five reversible, self-acting feeds, operating in all directions. Distance from centre of spindle to inside of frame, 26 inches. Compound tables have a movement of 26 inches longitudinally, and 28 inches transversely; and support a circular table 32 inches in diameter. Spindle has a vertical adjustment of 8 inches by screw, etc. Lubrication is provided by an automatic pump driven from cone shaft. Countershaft and wrenches included.



No. 10 VERTICAL MILLING MACHINE.

No. 10 VERTICAL MILLING MACHINE.

For the heaviest class of work. Usually constructed with large cones giving four changes of speed, without back gearing. Distance from centre of spindle to inside of frame, 32 inches; vertical distance from table to frame, $20\frac{1}{2}$ inches, and to spindle when in highest position, 27 inches. Spindle has a vertical adjustment of 10 inches by screw, etc., an automatic down feed, variable from 0 to $\frac{1}{8}$ inch without changing gears; also, slow and rapid hand movements. Compound tables have a movement of 28 inches longitudinally and 33 inches transversely, and are provided with an infinite gradation of automatic feed in all directions from 0 to $\frac{1}{2}$ inch to each revolution of the spindle, without changing gears. Circular table is 42 inches in diameter. Automatic lubricating pump, with arrangement for draining. Countershaft and wrenches included.



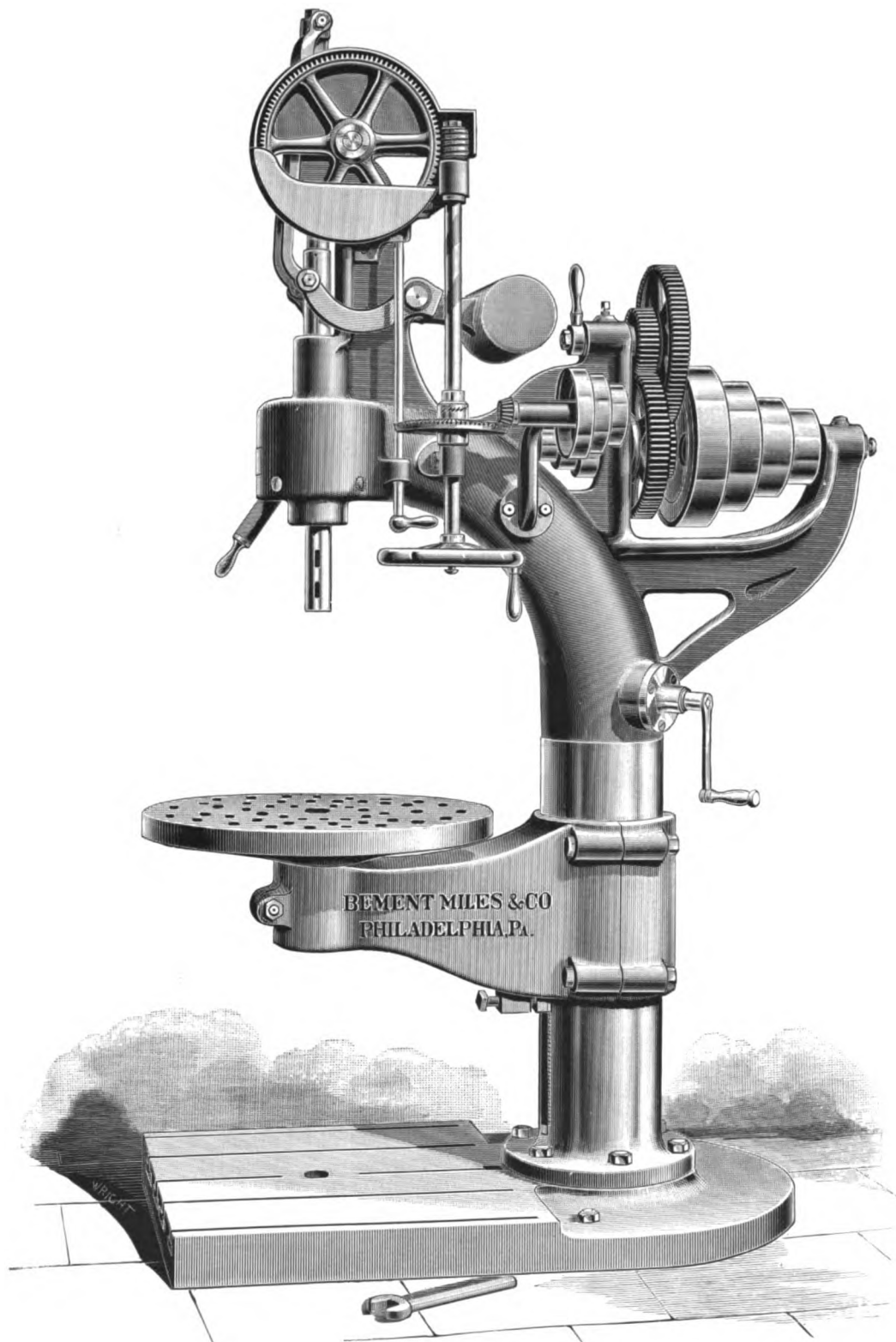
24-INCH VERTICAL DRILLING MACHINE.

24-INCH VERTICAL DRILLING MACHINE.

Distance from inside of column to centre of spindle, 12 inches, and greatest capacity from base plate to drill, 50 inches. Spindle has three speeds, 10 inches vertical traverse, three changes of feed, automatic stop arrangement, counterbalance and rapid hand movement by lever. Table turns on its centre and swings around column, the bracket resting upon a brass nut drilled to admit a taper pin for holding table correctly in a central position. Raising and lowering of table is effected by crank connected with an upright screw placed in a recess in front of column. Countershaft and wrenches included.

32-INCH VERTICAL DRILLING MACHINE.

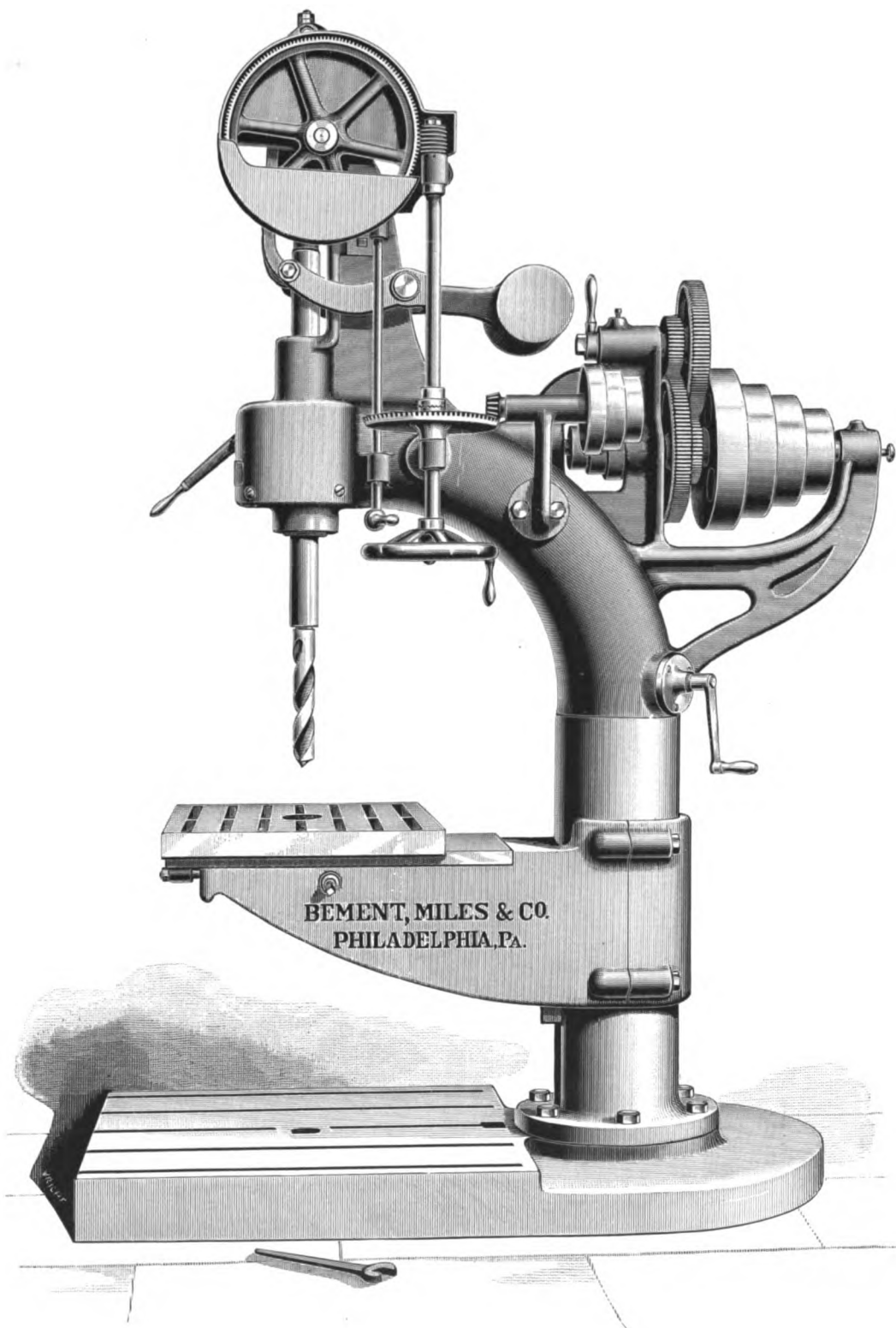
16 inches from inside of column to centre of spindle, and greatest distance between spindle and base plate, 52½ inches. Spindle has eight changes of speed by cone and back gearing, 10 inches vertical traverse, three automatic feeds, rapid hand movement and lever counterweight. Table, which is 24 inches in diameter, is raised and lowered by screw operated by crank on column, can be rotated on its axis, swung entirely around column, and rigidly clamped in any position. By means of a taper dowel pin, the table can be locked in a position centrally in line with spindle for the convenient use of a boring bar. Slotted base plate for heavy work. Countershaft and wrenches included.



40-INCH VERTICAL DRILLING MACHINE.

40-INCH VERTICAL DRILLING MACHINE.

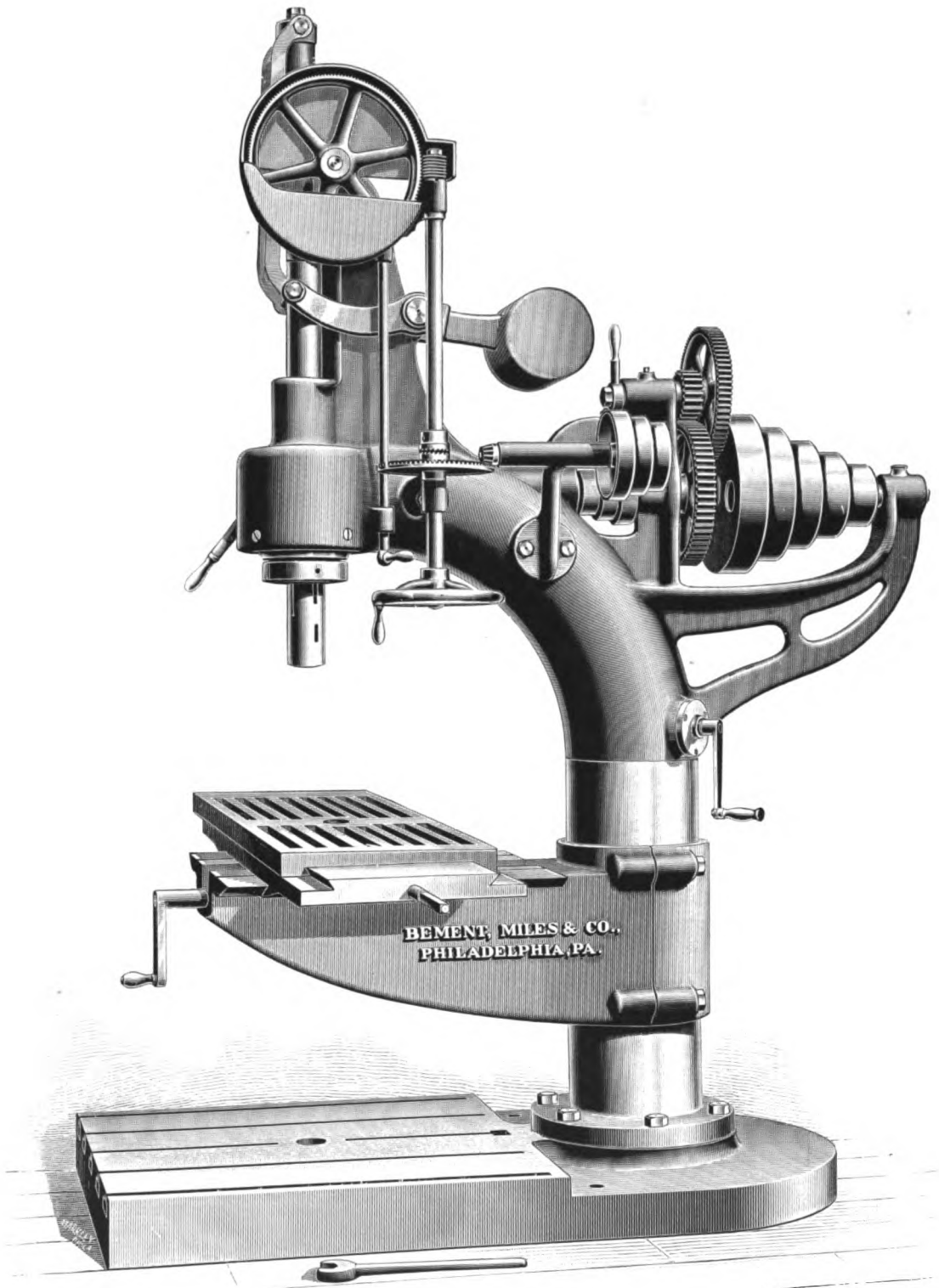
20 inches from inside of column to centre of spindle, and greatest distance between spindle and base plate, 53 inches. Spindle has eight changes of speed by cone and back gearing, 12 inches vertical traverse, three automatic feeds, rapid hand movement and lever counterweight. Table, which is 30 inches in diameter, is raised and lowered by screw operated by crank on column, can be rotated on its axis, swung entirely around column, and rigidly clamped in any position. By means of a taper dowel pin the table can be locked in a position centrally in line with spindle for the convenient use of a boring bar. Slotted base plate for heavy work. Countershaft and wrenches included. This machine is sometimes built with a rectangular sliding table, 28 inches by 20 inches. (See illustration of the 50-inch size.)



50-INCH VERTICAL DRILLING MACHINE.

50-INCH VERTICAL DRILLING MACHINE.

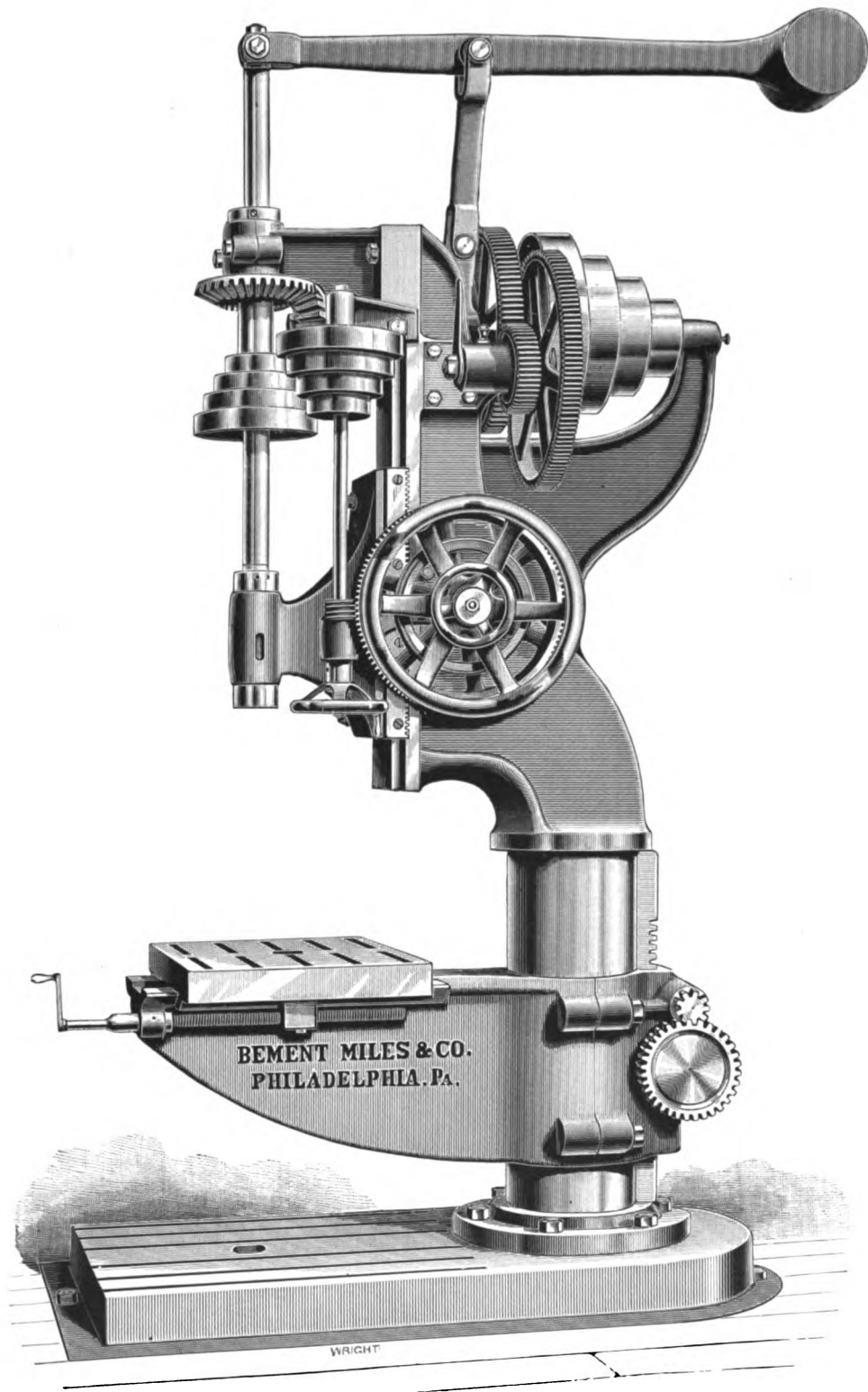
25 inches from inside of column to centre of spindle, and greatest distance between spindle and base plate, 56 inches. Spindle has eight changes of speed by cone and back gearing, 15 inches vertical traverse, three automatic feeds, rapid hand movement and lever counterweight. Table, which is 34 inches in diameter, is raised and lowered by screw operated by crank on column, can be rotated on its axis, swung entirely around column, and rigidly clamped in any position. By means of a taper dowel pin, the table can be locked in a position centrally in line with spindle for the convenient use of a boring bar. Slotted base plate for heavy work. Countershaft, wrenches, etc. This machine is sometimes built with a rectangular sliding table, 36 inches by 26 inches. (See illustration.)



60-INCH VERTICAL DRILLING MACHINE.

60-INCH VERTICAL DRILLING MACHINE.

30 inches from inside of column to centre of spindle, and greatest distance between spindle and base plate, 58 inches. Spindle has ten changes of speed by cone and back gearing, 18 inches vertical traverse, rapid hand movement and lever counterweight. Usually constructed with a rectangular sliding table, 38 inches by 28 inches, or with compound tables, as shown by illustration. Table is adjustable on the supporting bracket and can be swung entirely around the column, the raising and lowering being effected by a screw connected with crank on column. By means of a taper dowel pin, the table can be locked in a position centrally in line with spindle for the convenient use of a boring bar. Slotted base plate for work too large to go on table. Countershaft, wrenches, etc.



51-INCH VERTICAL DRILLING MACHINE, WITH ADJUSTABLE SPINDLE BEARING.

30-INCH VERTICAL DRILLING MACHINE,

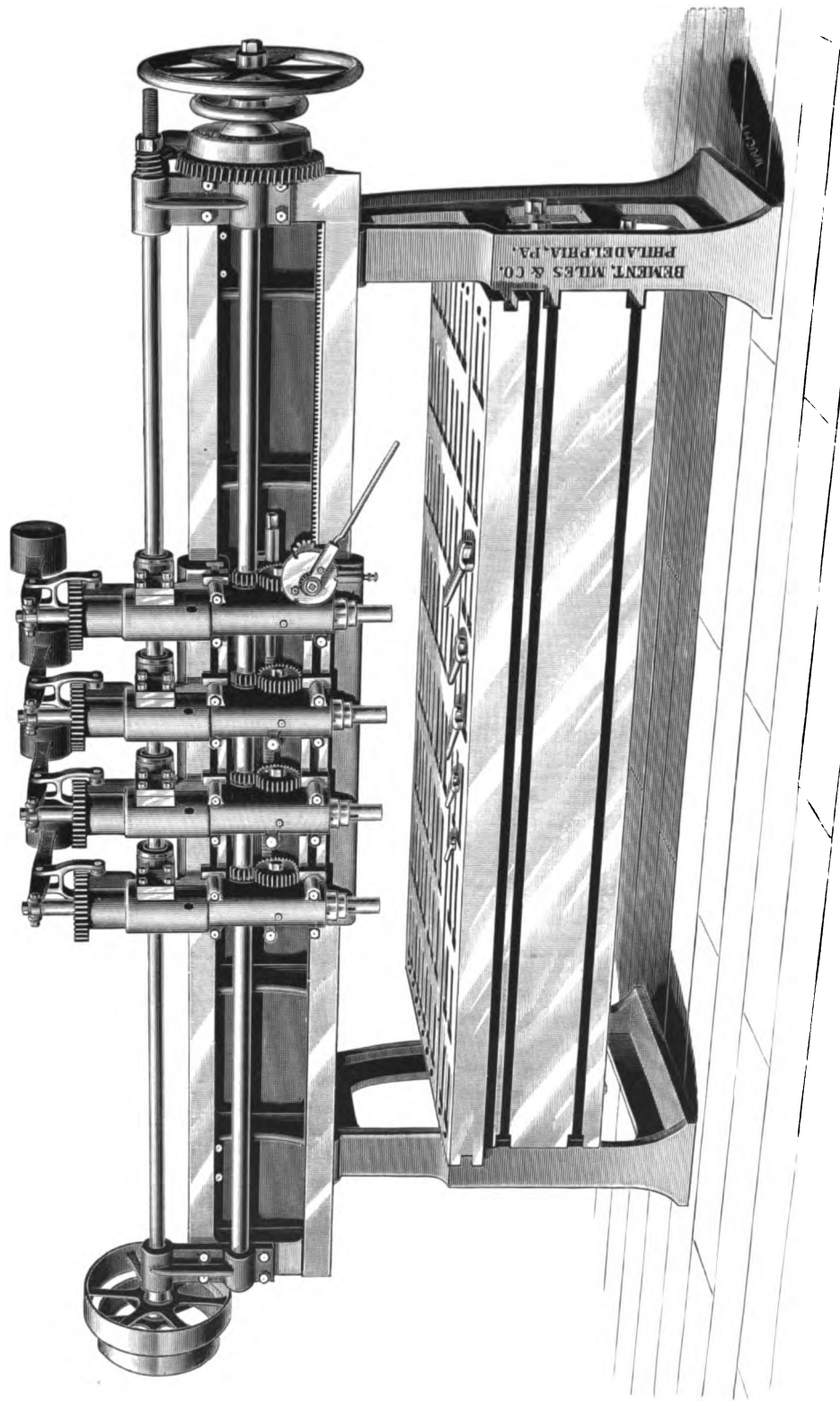
WITH ADJUSTABLE SPINDLE BEARING.

15½ inches from inside of column to centre of spindle, and greatest distance between spindle and base plate, 55 inches. Spindle has four speeds, 18 inches vertical traverse, three automatic feeds, rapid hand movement and lever counterweight. The circular table, which is 20 inches in diameter, is adjustable by screw on a bracket which may be swung entirely around the column and rigidly clamped in any position. Slotted base plate for large work. Countershaft and wrenches included.

51-INCH VERTICAL DRILLING MACHINE,

WITH ADJUSTABLE SPINDLE BEARING.

25½ inches from inside of column to centre of spindle, and greatest distance from spindle to base plate, 65 inches. Spindle has eight speeds by cone and back gearing, 26 inches vertical traverse, six automatic feeds, rapid hand movement and lever counterweight. Table, which is 22 inches x 32 inches, is adjustable by screw, can be raised or lowered, or swung entirely around the column and rigidly clamped in any position. Slotted base plate for large work. Countershaft and wrenches included.

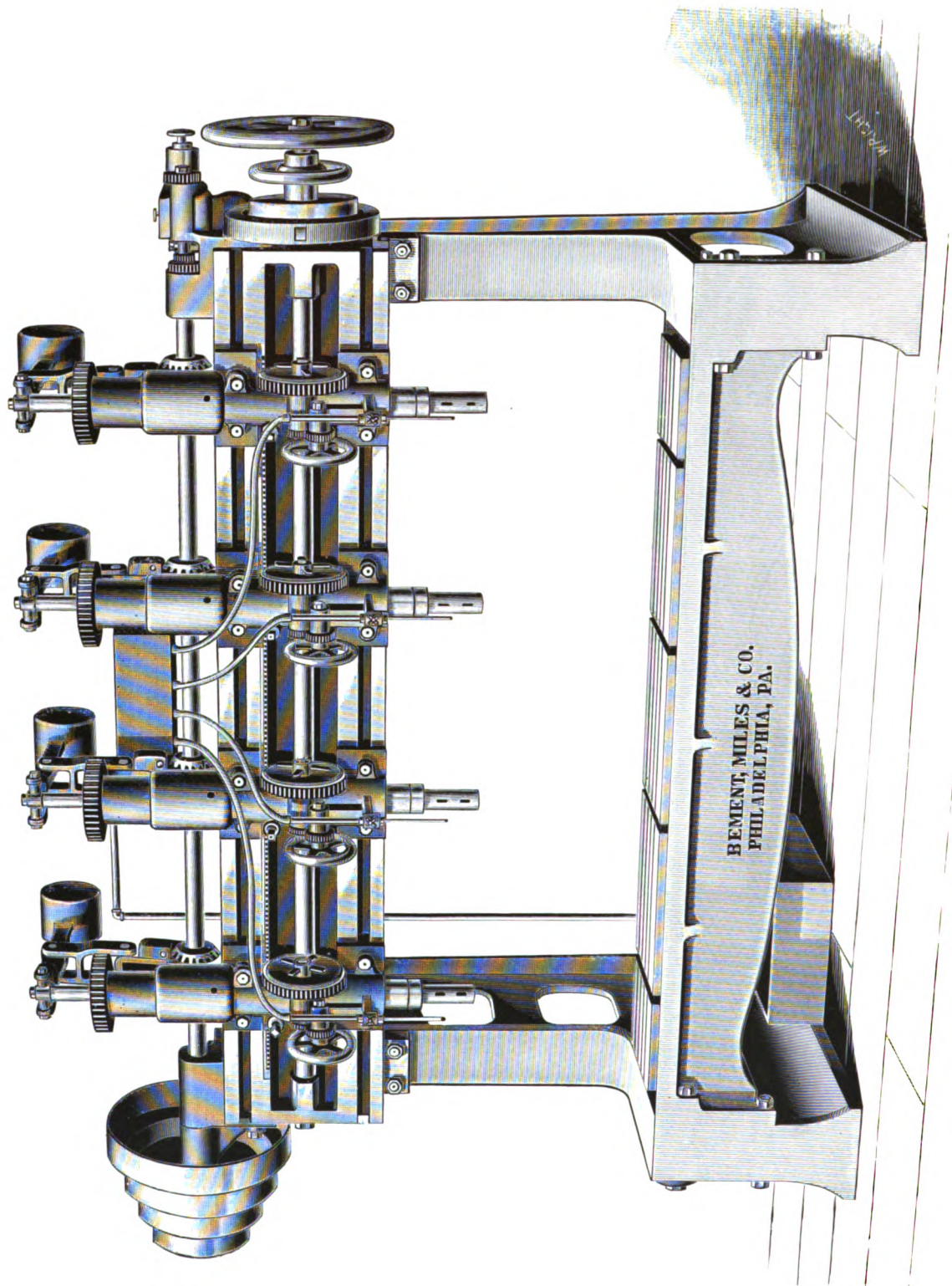


No. 1 MULTIPLE DRILLING MACHINE.

No. 1 MULTIPLE DRILLING MACHINE,

FOR DRILLING HOLES UP TO ONE INCH.

As shown by illustration, it has four self-feeding and counterbalanced spindle heads, with 10 inches spindle traverse, and two speeds adjustable to any distance apart of not less than $7\frac{1}{2}$ inches, the whole attached to a saddle, which is moved by rack and pinion on a cross slide of sufficient length for sheets 8 feet wide. Spindles are raised simultaneously by rapid hand motion, through a hand wheel, etc., at end of cross slide, and are readily changed in relative height to suit drills of unequal lengths. Table is moved backward and forward upon its supporting brackets by a pair of racks and connected pinions. The number of spindles may be varied from 2 to 6, or they may be applied directly to the cross slide, omitting the traversing saddle. The length of cross slide may be increased or diminished, as desired, and the movable table may be changed to a fixed one, or otherwise modified. When required, an automatic pump, with tanks and distributing pipes, will be provided for lubricating the spindles. Countershaft and wrenches included.



No. 2 MULTIPLE DRILLING MACHINE.

No. 2 MULTIPLE DRILLING MACHINE,

FOR 1½ INCH HOLES.

As shown by illustration, the machine is provided with four spindle heads, but it may have two or three, if preferred. Distance between uprights, 6 to 10 feet, as may be required. Spindles have four speeds, two automatic feeds, 12 inches traverse, lever counterbalance, quick return motion by hand wheel, etc., through a horizontal shaft, and independent lateral adjustment on cross slide by rack and pinion. Spindles also have an independent vertical adjustment; shortest distance between centres, 12 inches. An automatic pump, with tanks and distributing tubes, is provided for lubricating the drills. The table may be fixed, or movable, or it may be arranged for holding any kind of work. Countershaft and wrenches included.

No. 3 MULTIPLE DRILLING MACHINE,

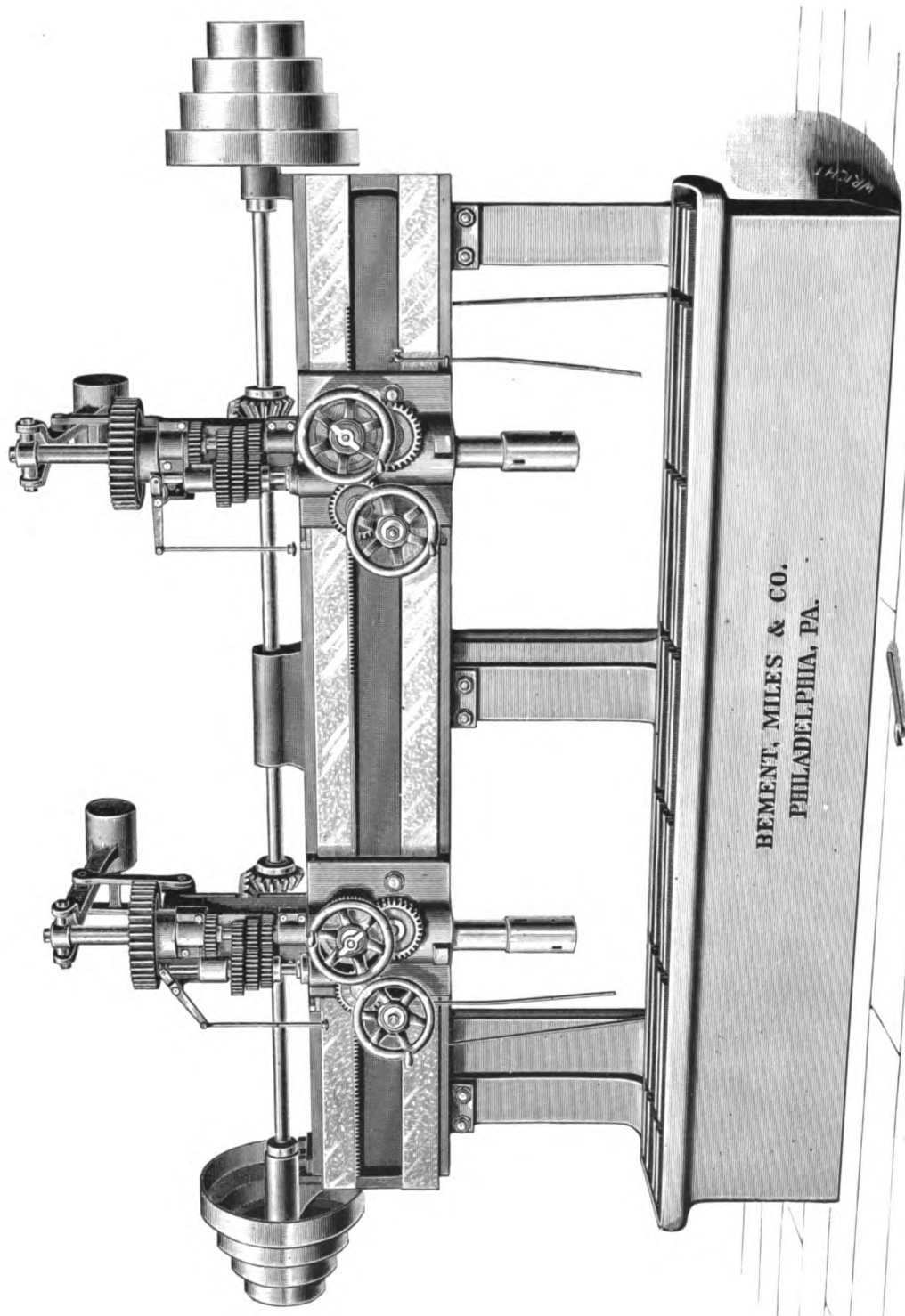
FOR DRILLING 2½ INCH HOLES, AND BORING UP TO 5 INCHES.

The general arrangement of this machine is similar to that of the No. 2, as shown by its illustration. The spindle heads, which may be from two to four in number, have four changes of speed, three automatic feeds, 15½ inches vertical spindle traverse, lever counterbalance, quick return motion by hand wheel, etc., through a horizontal shaft, and independent lateral adjustment on cross slide by rack and pinion. The spindles also have an independent vertical adjustment; shortest distance between centres, 14½ inches. An automatic pump, with tanks and distributing tubes, is provided for lubricating the drills. The distance between uprights, the arrangement of table, etc., can be varied to suit any requirements. Countershaft and wrenches included.

No. 4 MULTIPLE DRILLING MACHINE,

FOR DRILLING $3\frac{1}{2}$ INCH HOLES, AND BORING UP TO 8 INCHES.

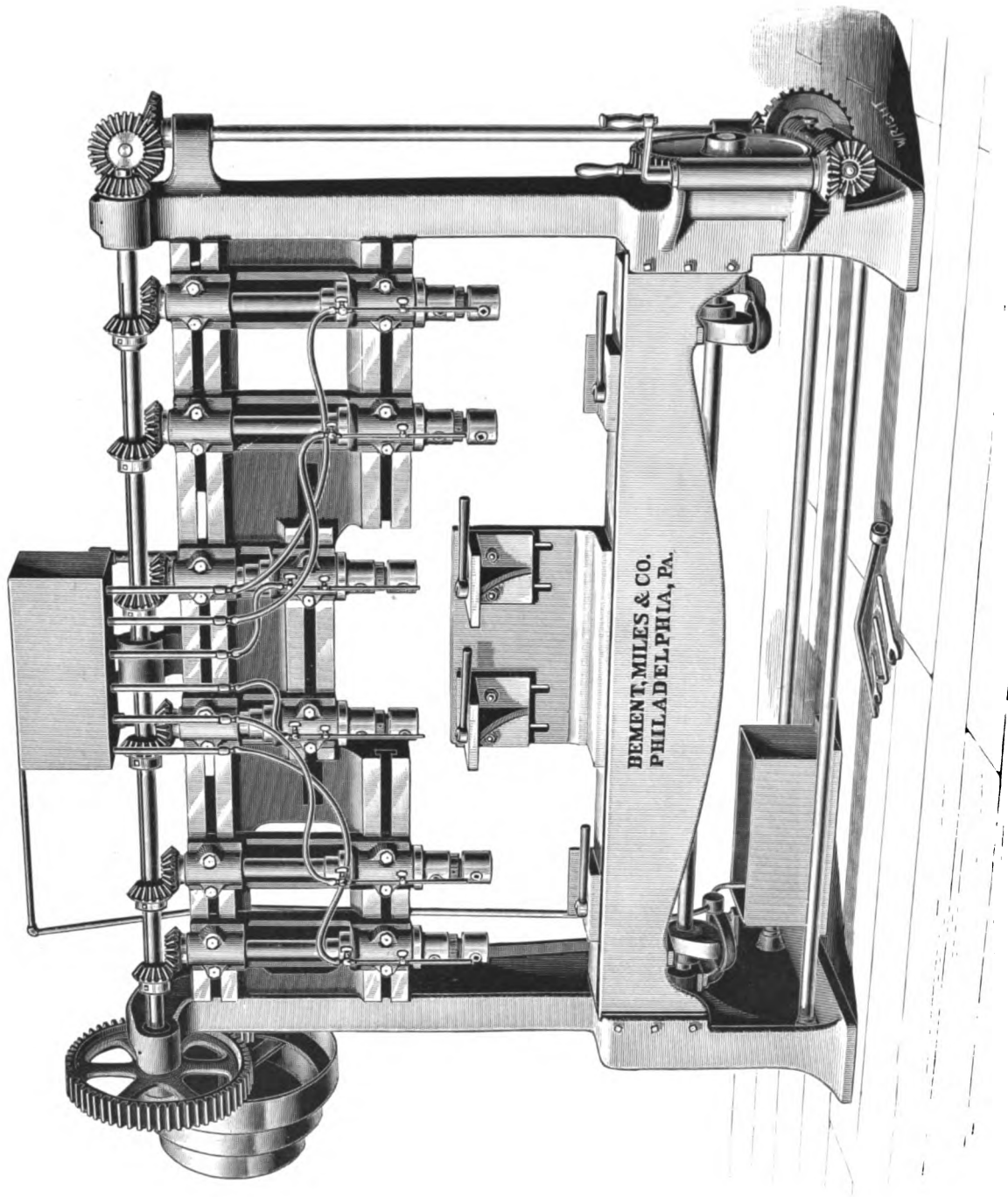
The general arrangement of this machine is similar to that of the No. 2, as shown by its illustration. The spindle heads, which may be made from two to four in number, have four changes of speed, three automatic feeds, $15\frac{1}{2}$ inches vertical spindle traverse, lever counterbalance, quick return motion by hand wheel, etc., through a horizontal shaft, and independent lateral adjustment on cross slide by rack and pinion. The spindles also have an independent vertical adjustment; shortest distance between centres, 2 feet 6 inches. An automatic pump, with tanks and distributing tubes, is provided for lubricating the drills. The distance between uprights, the arrangement of table, etc., can be varied to suit any requirements. Countershaft and wrenches included.



TWO-SPINDLE LOCOMOTIVE CONNECTING ROD DRILLING MACHINE.

TWO-SPINDLE LOCOMOTIVE CONNECT- ING ROD DRILLING MACHINE.

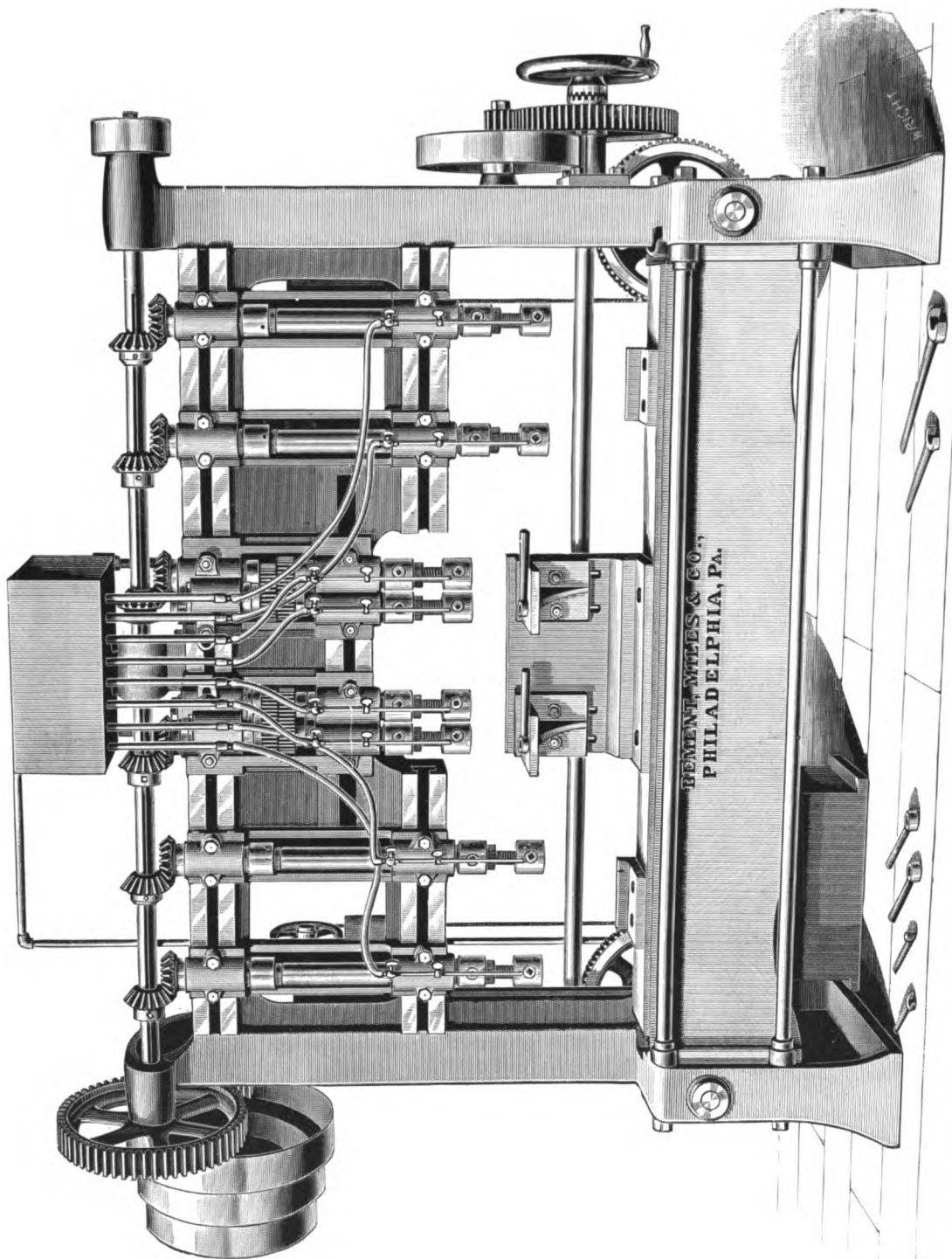
Designed for drilling at one time both ends of locomotive connecting and parallel rods. Extreme distance between centres, 10 feet; and shortest distance, 3 feet. Power of each head is sufficient to drill a $3\frac{1}{2}$ -inch hole in the solid material, and to bore a 9-inch hole. Spindles are independently driven and have four speeds, three feeds through a distance of $15\frac{1}{2}$ inches, quick return motion, lever counterbalance and lateral adjustment on cross slide by rack and pinion. Each spindle is adjustable vertically. Two automatic pumps, etc., are provided for lubricating the drills. Countershafts and wrenches included.



SIX-SPINDLE ARCH BAR DRILLING MACHINE.

SIX-SPINDLE DRILLING MACHINE.

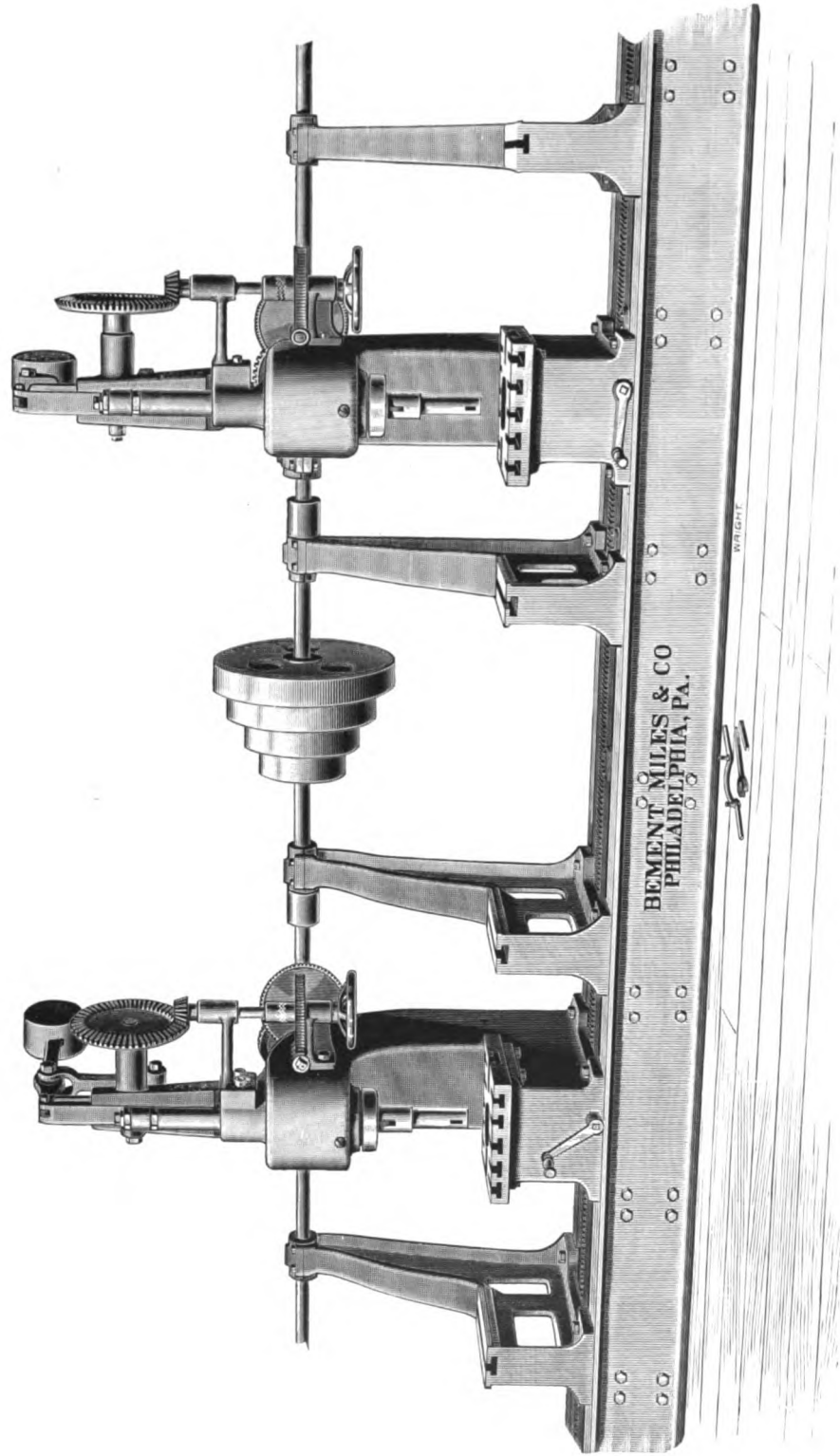
Specially arranged for car truck frames. Has six connected steel spindles, with three changes of speed, adjustable to any required position horizontally, and variable in length by sliding steel sockets. Table is fed upward automatically by cams, with quick return movement ; also movable by hand, and has holding fixtures with vertical adjustment. Pumps, tanks, countershaft and wrenches included.



EIGHT-SPINDLE ARCH BAR DRILLING MACHINE.

EIGHT-SPINDLE ARCH BAR DRILLING MACHINE.

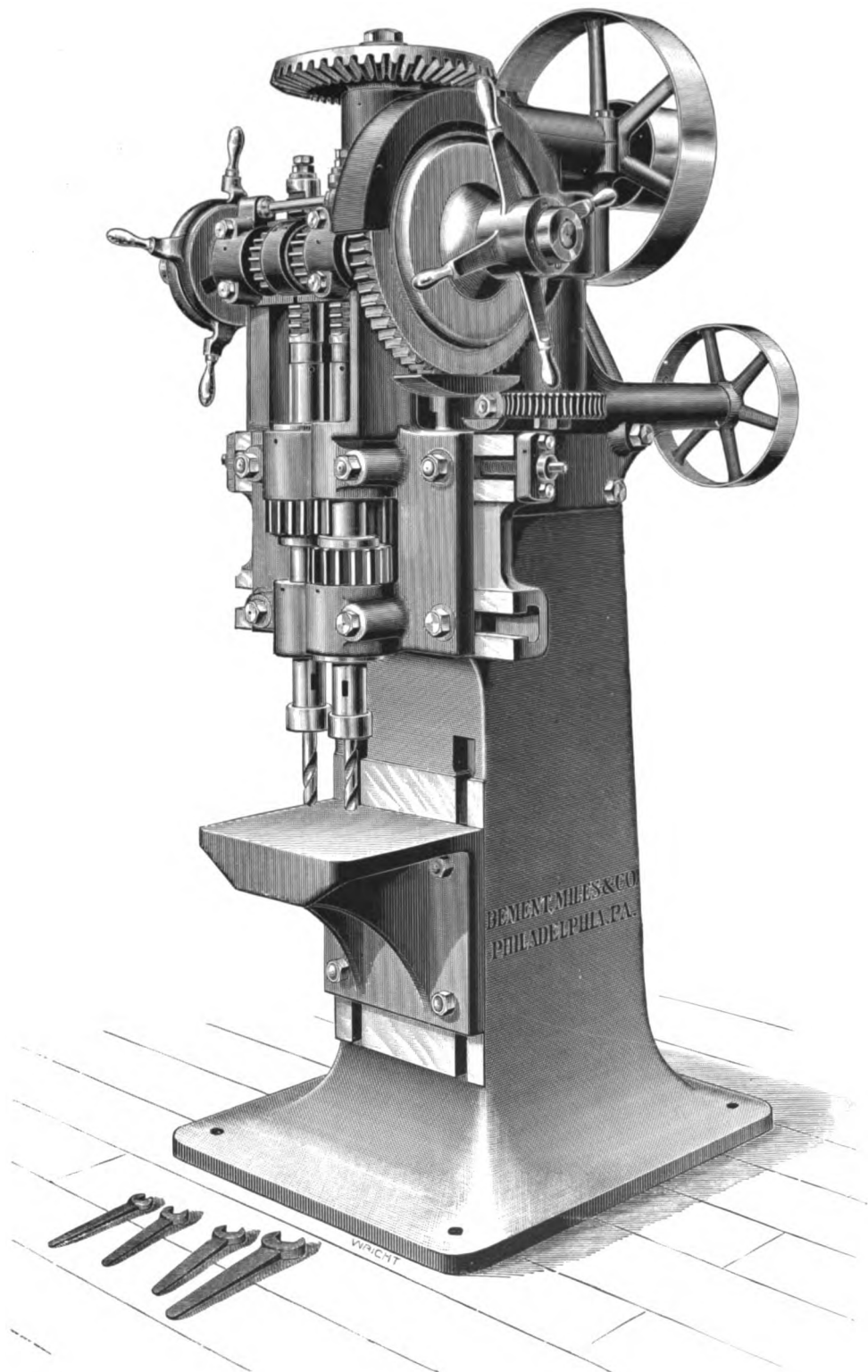
Specially arranged for drilling car truck frames. Has eight connected steel spindles, with three changes of speed, adjustable to any required position horizontally, and variable in length by sliding steel sockets, which are threaded and provided with steel nuts for adjustment to any position. The table, which is counterweighted, is fed upward automatically by vertical steel racks geared together, and is also provided with a rapid hand movement, and holding fixtures with vertical adjustment. Pump, tanks, countershaft and wrenches included.



BRIDGE LINK DRILLING MACHINE.

BRIDGE LINK DRILLING MACHINE.

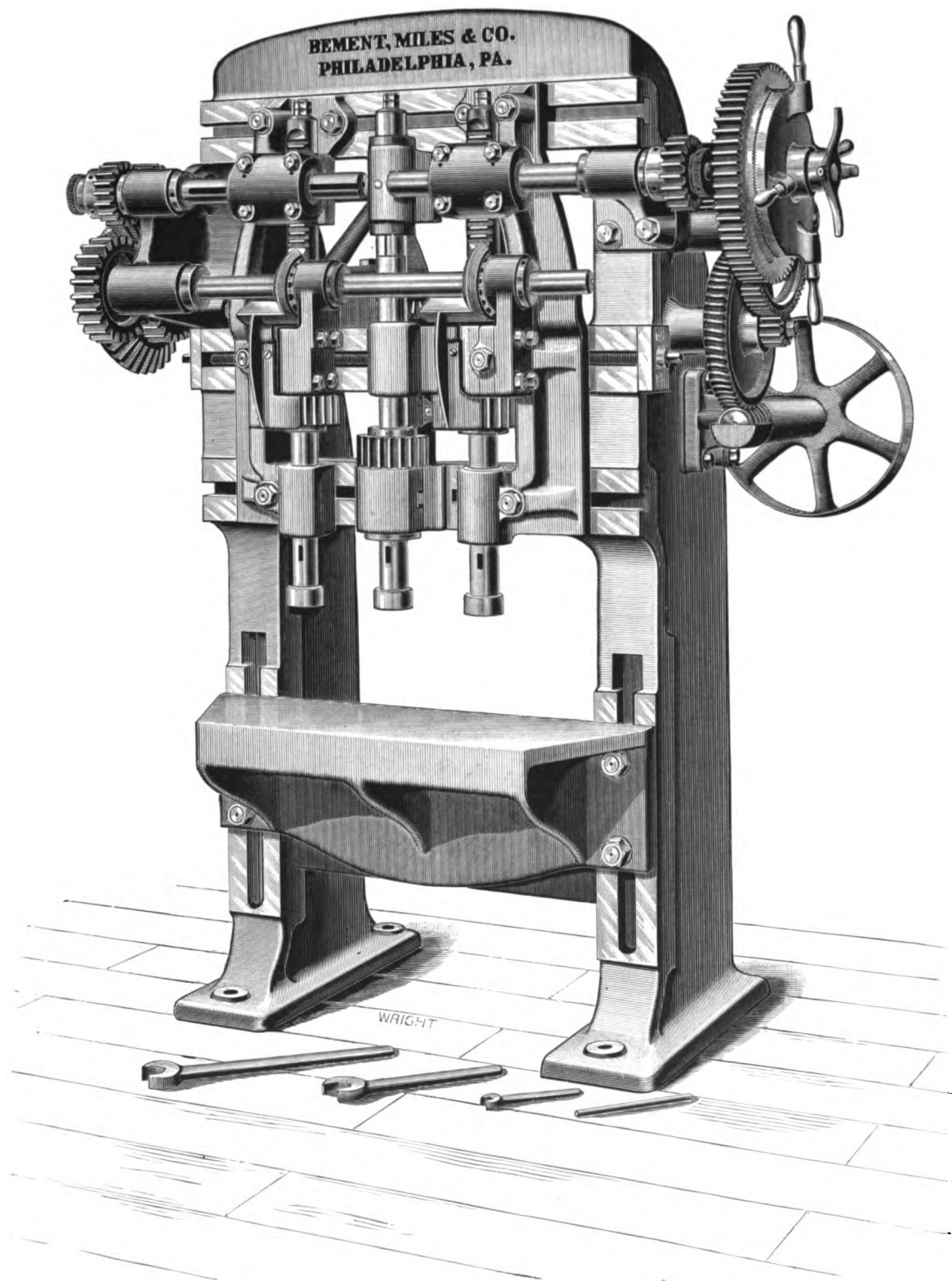
Consists of two heavy and powerful drilling machines of special construction, which are clamped to a bed of any required length and adjustable to any position. Each drill has four double geared driving speeds, three changes of self-acting feed, and 12 inches spindle traverse, with quick return movement by hand and counterbalance. Countershaft and wrenches included.



TWO-SPINDLE RAIL DRILLING MACHINE.

TWO-SPINDLE RAIL DRILLING MACHINE.

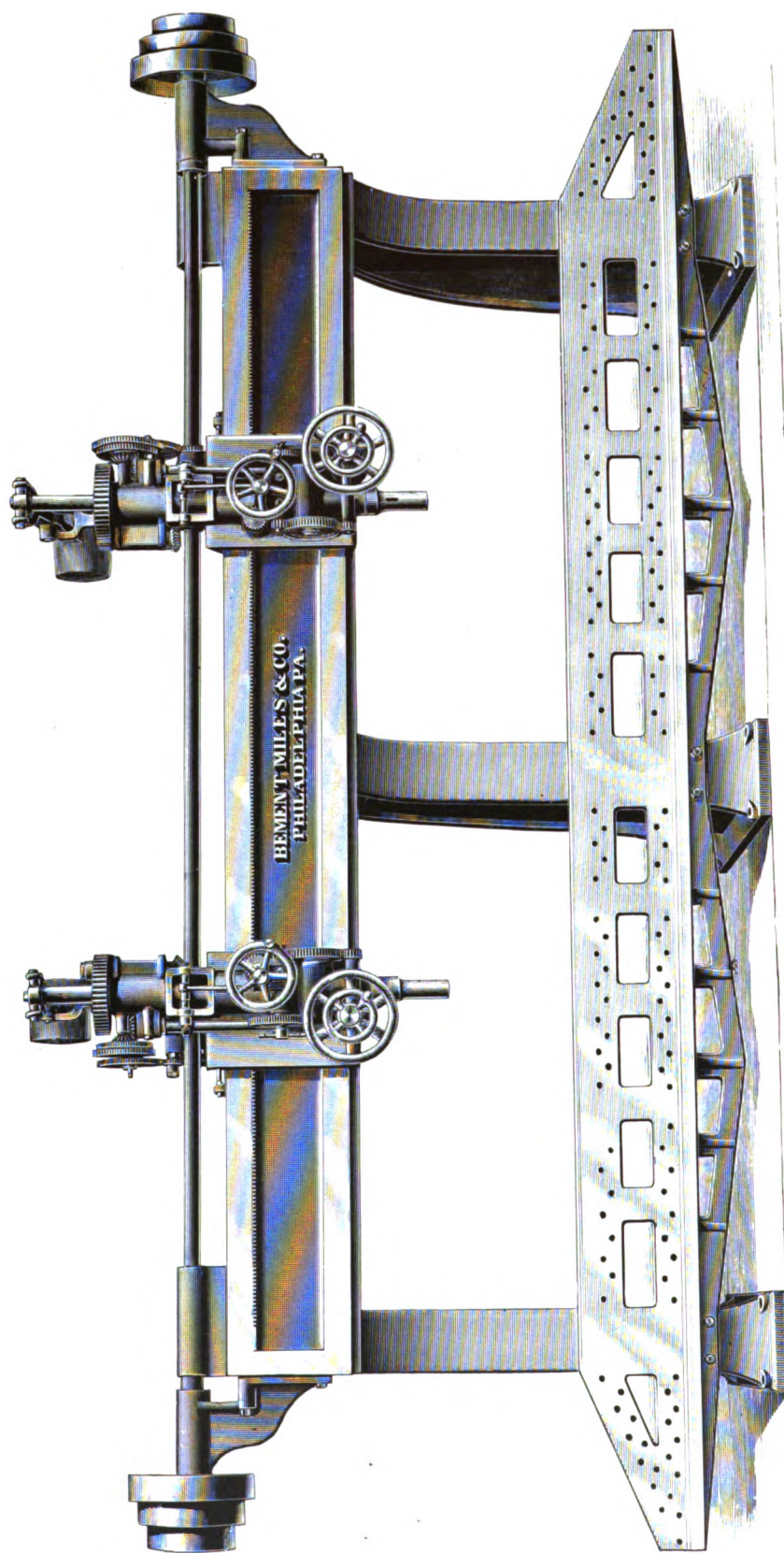
Will drill holes with a variation in distance apart of from 4 inches to 11 inches. Each spindle saddle is adjusted laterally on a cross slide by a separate screw, and the stand for the driving works is moved forward and backward to suit, also by a screw, there being a graduation on the frame for convenient setting to any required distance between centres of holes. Power feed by rack and pinion, etc., with quick return by hand. Each spindle may be separately and quickly adjusted up or down to compensate for the unequal wear of drills. Driven by steel gearing. Countershaft and wrenches included.



THREE-SPINDLE RAIL DRILLING MACHINE.

THREE-SPINDLE RAIL DRILLING MACHINE.

Will drill three holes at once, with a variation in distance apart from middle spindle of from 4 inches to 12 inches. The middle spindle being in a fixed position, the two others are adjusted laterally on a cross slide by separate screws. Very powerful feed by a rack and pinion, etc., with quick return by hand. Each spindle may be separately and quickly adjusted up or down to compensate for the wear of drills. Counter-shaft and wrenches included.



No. 2 LOCOMOTIVE FRAME DRILLING MACHINE.

No. 1 LOCOMOTIVE FRAME DRILLING MACHINE.

Has two heads separately driven, and entirely independent, each movable to any position on cross slide. Spindles have three changes of speed, 14 inches vertical traverse, two self-acting feeds, lever counterbalance, and rapid hand movement, both vertical and horizontal, by rack and pinion. As usually constructed, the machine has an extreme distance between spindles of 17 feet, but this may be increased or diminished, as required. The table has horizontal and vertical surfaces for holding frames in any position. Two countershafts and the necessary wrenches included.

No. 2 LOCOMOTIVE FRAME DRILLING MACHINE.

For the heaviest class of work. Has two heads separately driven and entirely independent, each movable to any position on cross slide. If preferred, three heads may be used instead of two. Spindles have three changes of speed, 16 inches vertical traverse, 4 inches in and out adjustment, two self-acting feeds, lever counterbalance, and rapid hand movement, both vertical and horizontal, by rack and pinion. As usually constructed, the machine has an extreme distance between spindles of 23 feet, but it may be increased or diminished, as required. The table has horizontal and vertical surfaces for holding frames in any position. Two countershafts and the necessary wrenches included.



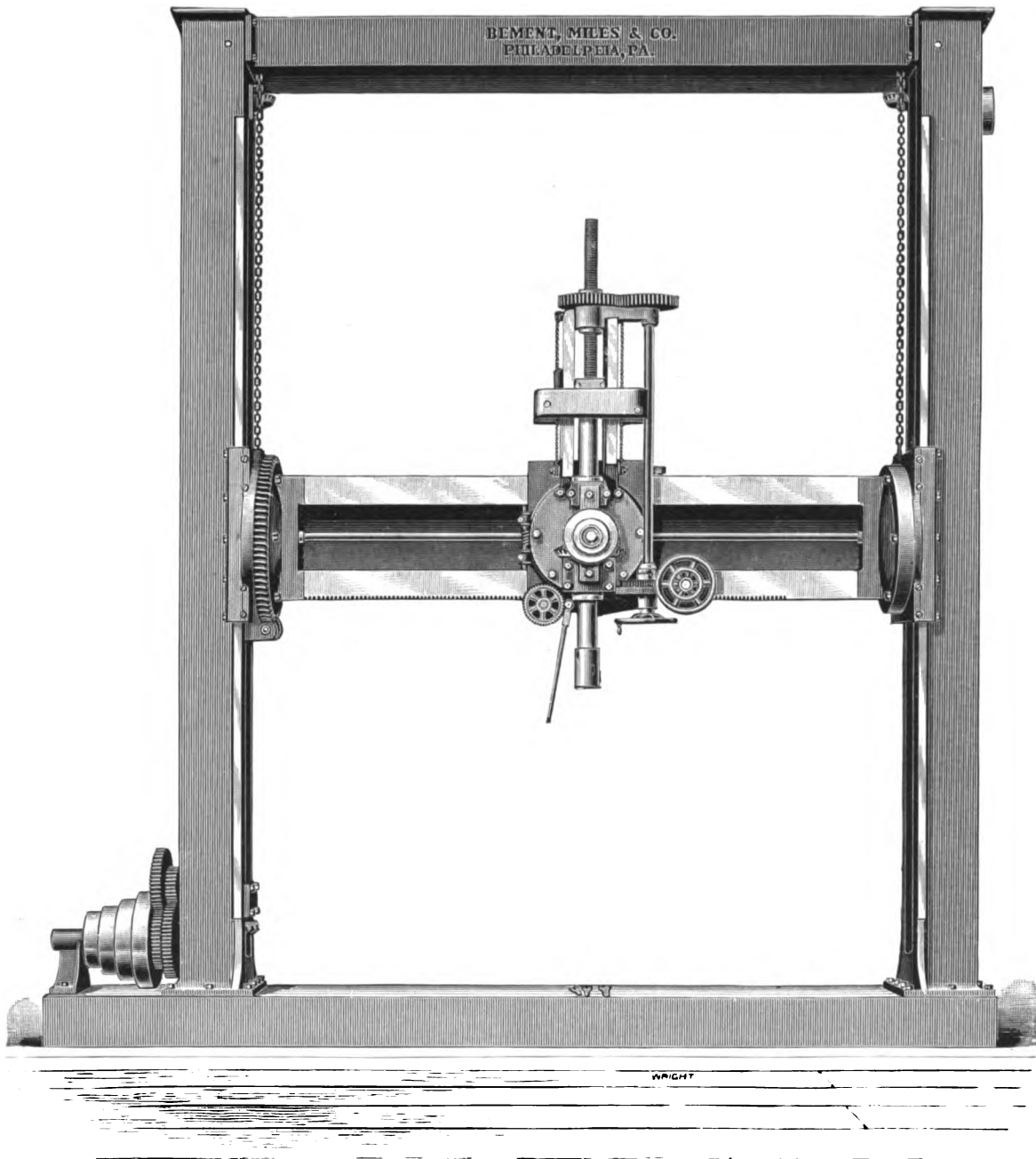
SUSPENDED DRILLING MACHINE.

SUSPENDED DRILLING MACHINE.

Intended to be attached to ceiling or overhead framing, leaving space below entirely clear, so that boiler sheets and other large objects can be drilled in any part of their surface. Driven by cone with three changes for 3 $\frac{1}{2}$ -inch belt. Traverse of spindle, 12 inches. Distance from top of frame to end of spindle in highest position, 69 inches. Countershaft included.

SUSPENDED DRILLING MACHINE, BACK GEARED.

Intended to be attached to ceiling or overhead framing, leaving the space below entirely clear, so that boiler sheets and other large objects can be drilled on any part of their surface. Distance from top of frame to end of spindle in highest position, 6 feet 8 inches. Cone has three changes, and is connected with two pairs of gears, giving six motions to spindle, the locking of one or the other pairs of gears being effected by a lever and upright rod conveniently placed. Traverse of spindle, 20 inches, with counterbalance. Countershaft, etc., included.



No. 1 UNIVERSAL DRILLING MACHINE.

No. 1 UNIVERSAL DRILLING MACHINE.

Constructed of different dimensions, usually 10 feet to 14 feet between posts, and of any desired height. It is provided with one or two saddles, as required. Spindle is $3\frac{1}{4}$ inches in diameter, with 20 inches traverse, eight speeds in either direction, six self-acting feeds, rapid hand movement and counterweight. Saddle is adjustable along the cross slide by rack and pinion. Both the saddle and cross slide swivel, by which means a hole may be drilled in any direction. Cross slide is counterweighted and is vertically adjustable by power. If desired, the machine can be arranged for tapping. Countershaft and wrenches included.

No. 2 UNIVERSAL DRILLING MACHINE.

Constructed of various dimensions, usually 14 feet to 18 feet between posts, and of any desired height. It is provided with one or two saddles, as required. Spindle is $5\frac{1}{4}$ inches in diameter, and has 37 inches traverse, eight speeds in either direction, three automatic feeds, rapid hand movement and counterweight. Saddle is adjustable along the cross slide by rack and pinion. Both the saddle and cross slide swivel, by which means a hole may be drilled in any direction. The cross slide is counterweighted and is vertically adjustable by power. If desired, the machine can be arranged for tapping. Countershaft and wrenches included.

PLATE DRILLING MACHINE.

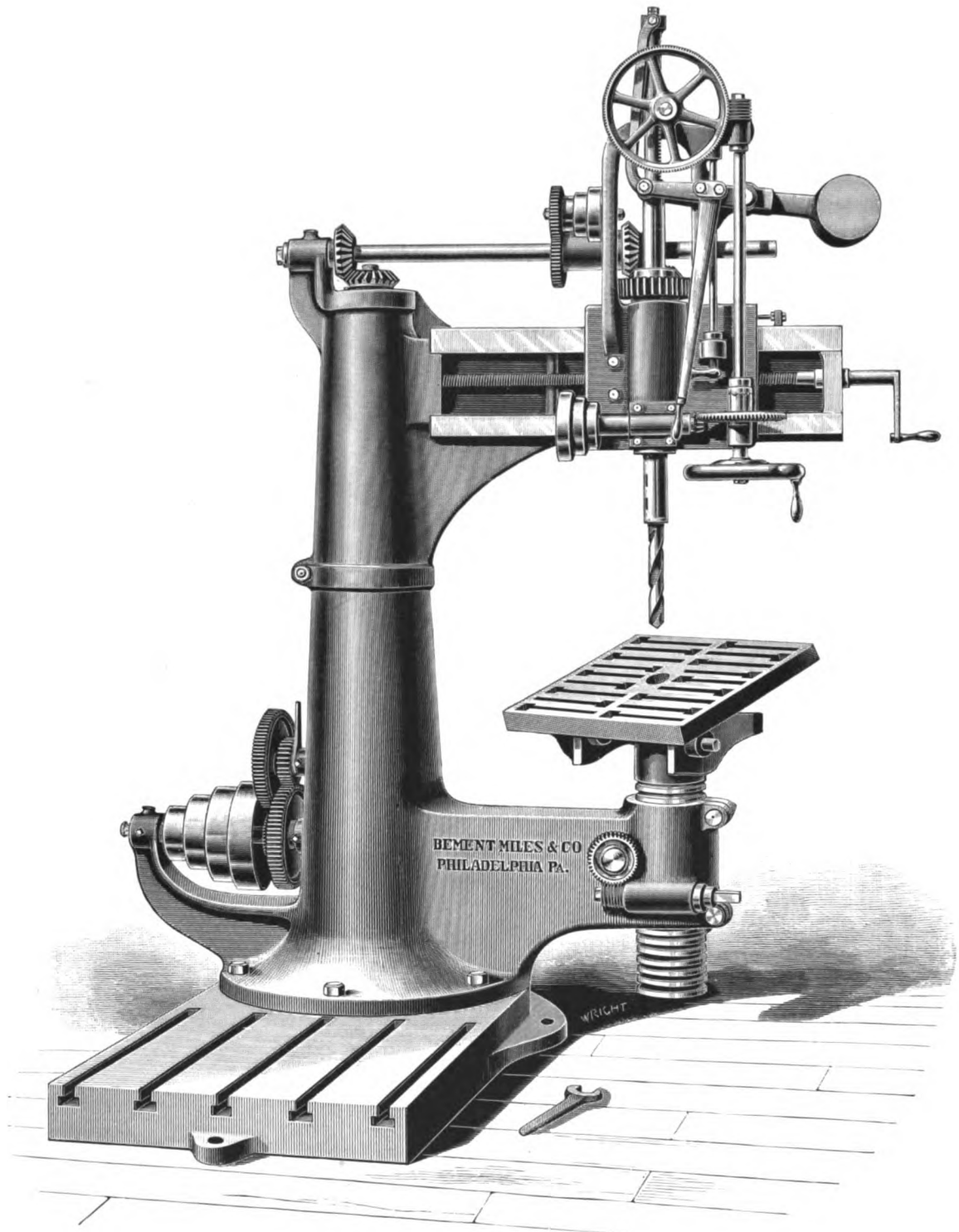
For boiler plates, bars, etc. Hand feeding, with three driving speeds. Traverse of spindle, 18 inches, and distance from centre of same to frame, 29 inches. End of spindle in highest position, 48 inches from floor. Countershaft and wrenches included.

PLATE COUNTERSINKING DRILLING MACHINE.

For ship work, etc. Distance from frame to centre of spindle, 36 inches. Spindle has 5 inches vertical traverse, brought down by treadle, and raised by counterweight, with internal sliding drill socket for vertical adjustment to the work. End of drill socket in highest position is 46 inches from floor. Countershaft and wrenches included.

PULLEY DRILLING AND TAPPING MACHINE.

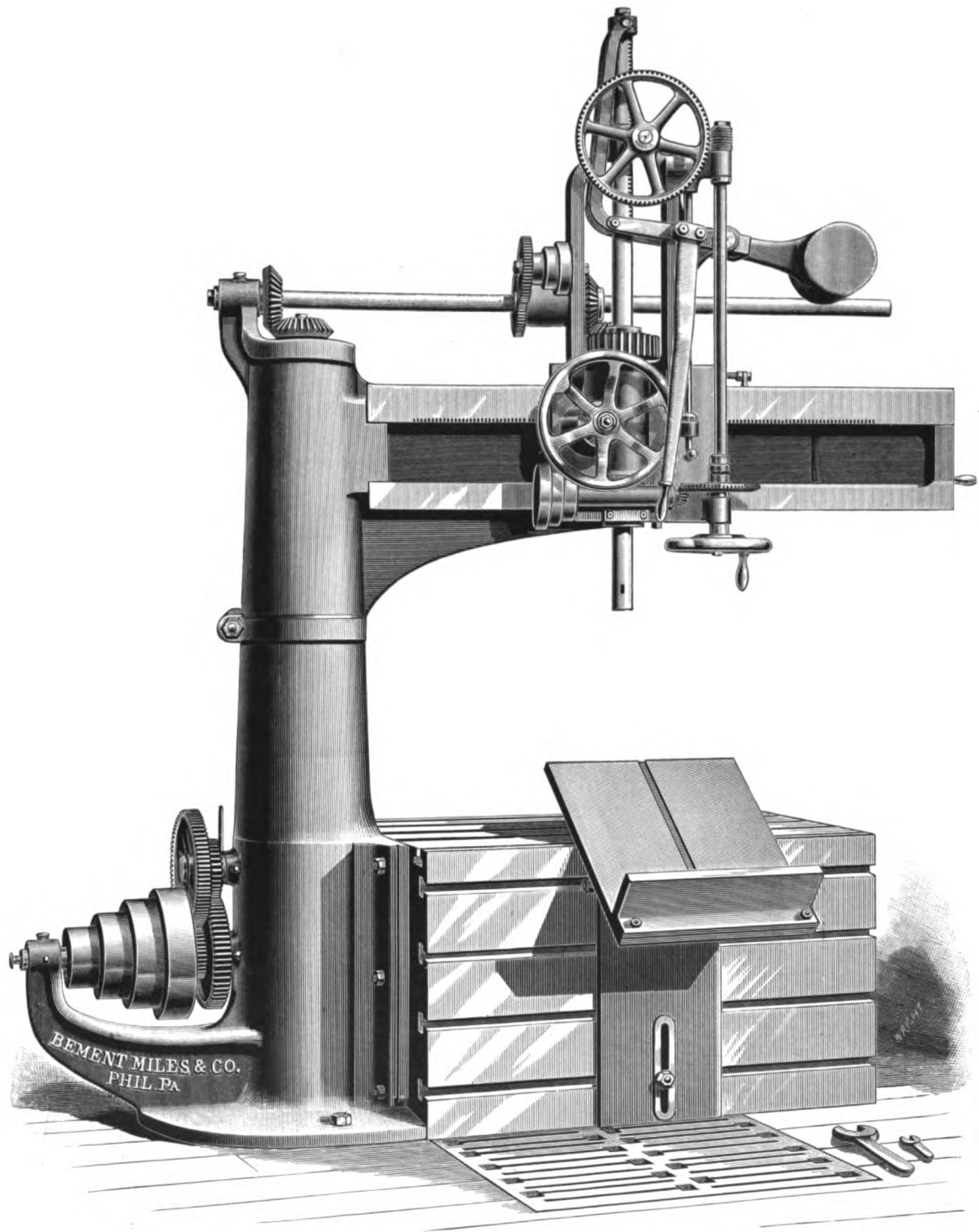
Will drill and tap the hubs of pulleys from 56 inches to 12 inches in diameter, working between the hub and rim. Saddle supporting the work is adjusted vertically by screw and gearing; reversing motion for tap by clutch operated by hand lever; two driving motions giving the necessary change of speeds for drilling and tapping. Countershaft and wrenches included.



4½-FOOT RADIAL DRILLING MACHINE.

4¹/₂-FOOT RADIAL DRILLING MACHINE.

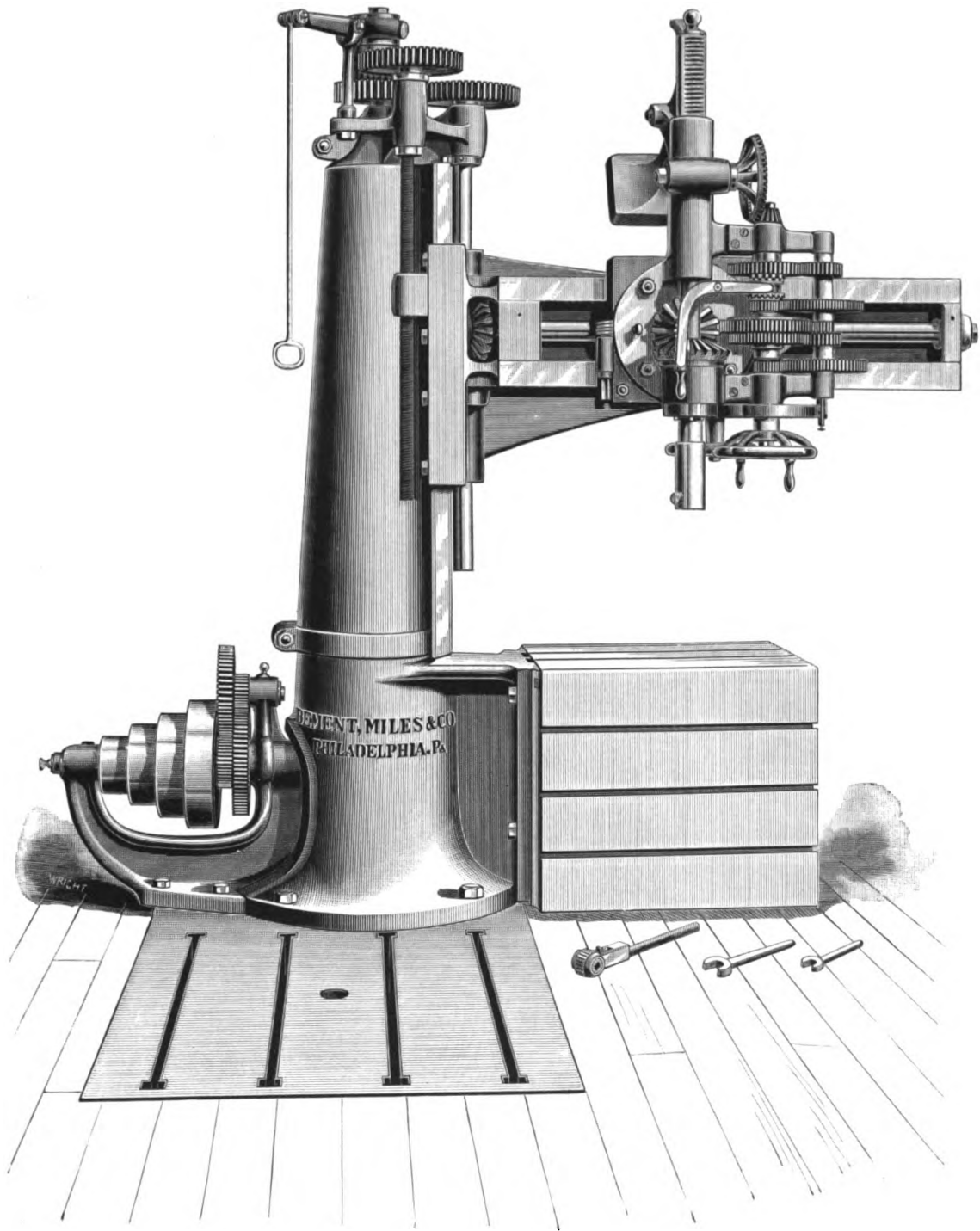
Distance from centre of column to end of arm, 4¹/₂ feet; greatest capacity from spindle to table, 26 inches, and from spindle to slotted base plate, 52 inches. Spindle has eight changes of speed by cone and gearing, 12 inches vertical traverse, three automatic feeds, counterbalance and rapid hand movement by lever. Table revolves on a circular rack, can be adjusted and secured at any angle from horizontal to perpendicular, and has a vertical adjustment of 14 inches. Slotted base plate, with planed surface 32 inches square, for large work. Countershaft and wrenches included.



6-FOOT RADIAL DRILLING MACHINE.

6-FOOT RADIAL DRILLING MACHINE.

Distance from centre of column to end of arm, 6 feet; greatest capacity from spindle to table, 31 inches, and to slotted base plate on floor level, 61 inches. Spindle has eight speeds by cone and gearing, 16 inches vertical traverse, three changes of automatic feed, counterbalance, and rapid hand movement by lever; movement of saddle on radial arm by rack and pinion. Table is of box form, having horizontal and vertical planed surfaces with slots for holding work. Adjustable table for angular drilling. Countershaft and wrenches included. Extra base plate on floor level provided when so ordered.



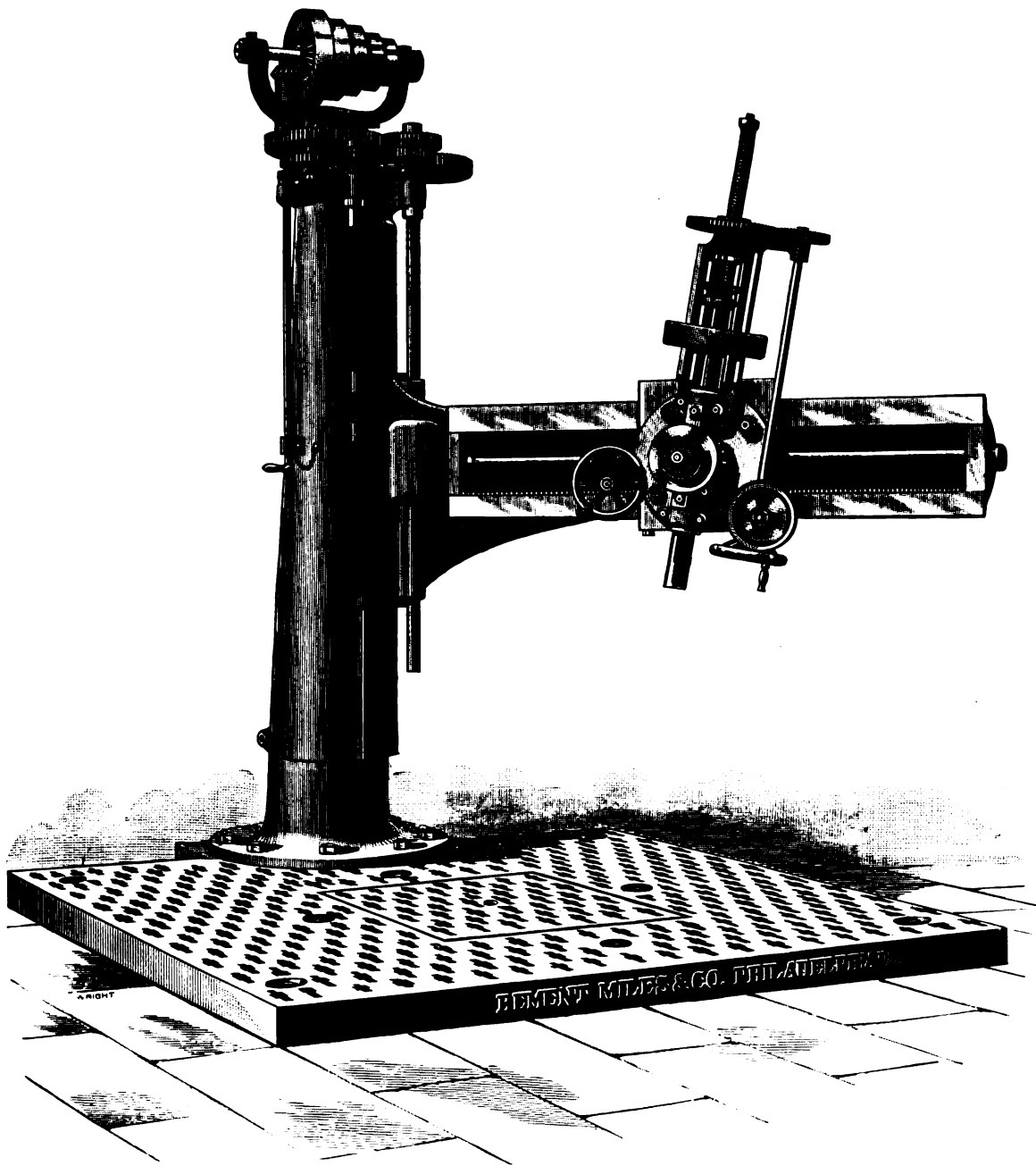
6-FOOT RADIAL DRILLING MACHINE, WITH VERTICALLY ADJUSTABLE ARM.

6-FOOT RADIAL DRILLING MACHINE,

WITH VERTICALLY ADJUSTABLE ARM.

Distance from centre of column to end of arm, 6 feet, and spindle can be moved outward sufficiently to drill or bore in the centre of a 102-inch circle. Greatest capacity from spindle to table, 35 inches, and to base plate, 62 inches. Spindle can be swivelled on saddle ; has eight speeds by cone and gearing, 17 inches vertical traverse, four automatic feeds, suitably arranged for drilling and boring, rapid hand movements and lever counterweight. Radial arm can be raised and lowered by power through a distance of 29 inches. Slotted box table for holding work, and base plate on floor level. Countershaft and wrenches included.

The above is sometimes built with a rotating radial arm, rendering it an entirely universal machine.



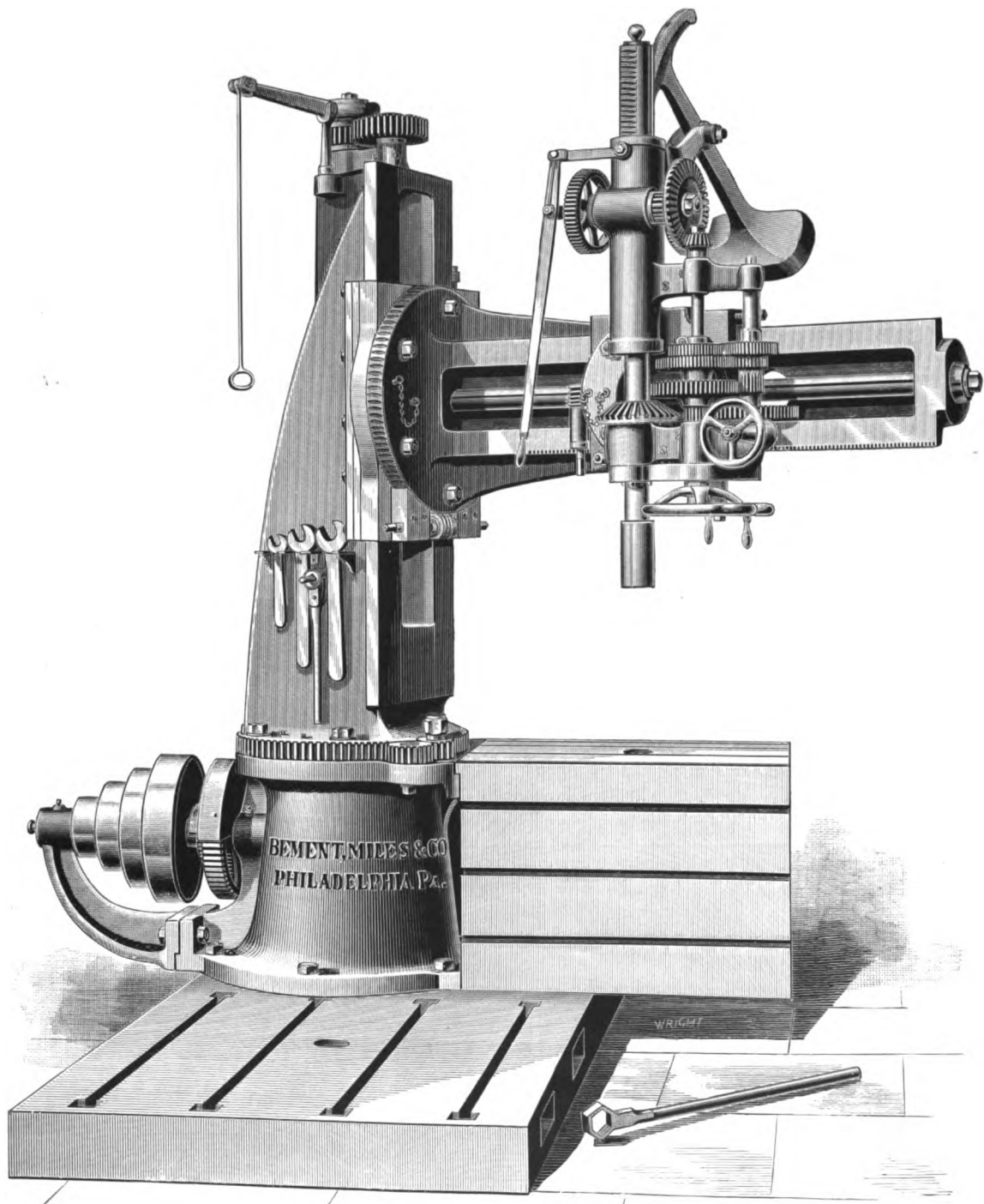
10-FOOT RADIAL DRILLING MACHINE.

8-FOOT RADIAL DRILLING MACHINE.

Distance from centre of column to end of arm 8 feet, and greatest distance from base plate to lower end of spindle $5\frac{1}{2}$ feet. Driven by cone of four changes, connected with two pairs of intermediate gears, giving eight motions to spindle. Arm slides by power upon a flat bearing, forming part of a sleeve surrounding the post, around which it revolves freely upon friction rollers. Spindle swivels to any angle, has 18 inches traverse, and three changes of automatic feed, also hand movement. Base plate consists of two securely ribbed slotted surfaces standing at right angles to each other, or a rectangular plate, with removable centre piece, as may be required. Countershaft, wrenches, etc., included.

10-FOOT RADIAL DRILLING MACHINE.

Distance from centre of column to end of arm 10 feet, and greatest distance from base plate to lower end of spindle 7 feet. Driven by cone of five changes, connected with two pairs of intermediate gears, giving ten motions to spindle. Arm slides by power upon a flat bearing forming part of a sleeve surrounding the post, around which it revolves freely upon friction rollers. Spindle swivels to any angle, has 18 inches traverse, three changes of automatic feed, and hand movement. Base plate is 10 feet square, with slots; and has a central movable plate $3\frac{1}{2}$ feet by 4 feet for pit.



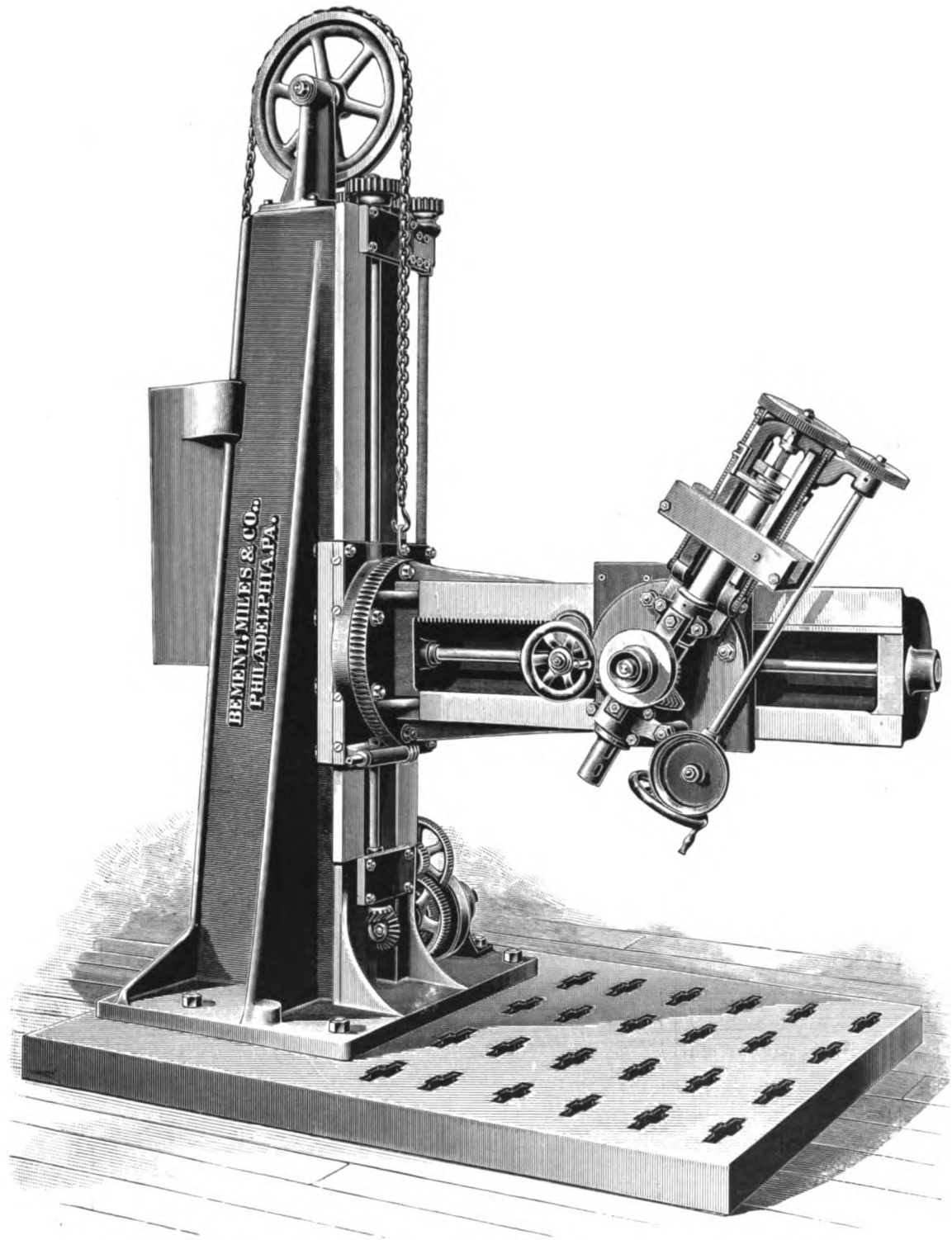
7-FOOT UNIVERSAL RADIAL DRILLING MACHINE.

7-FOOT UNIVERSAL RADIAL DRILLING MACHINE.

Distance from centre of column to end of arm, 7 feet; greatest capacity from spindle to table, 40 inches, and to base plate on floor level, 66 inches. Spindle can swivel on its saddle; has eight speeds by cone and gearing, 20 inches vertical traverse, six automatic feeds suitably arranged for drilling and boring, rapid hand movement and lever counterweights. Radial arm can be rotated on its own axis by worm gear for angular drilling, and is raised and lowered by power through a distance of 38 inches. Slotted table for holding work and base plate at right angles on floor level. Countershaft and wrenches included.

9-FOOT UNIVERSAL RADIAL DRILLING MACHINE.

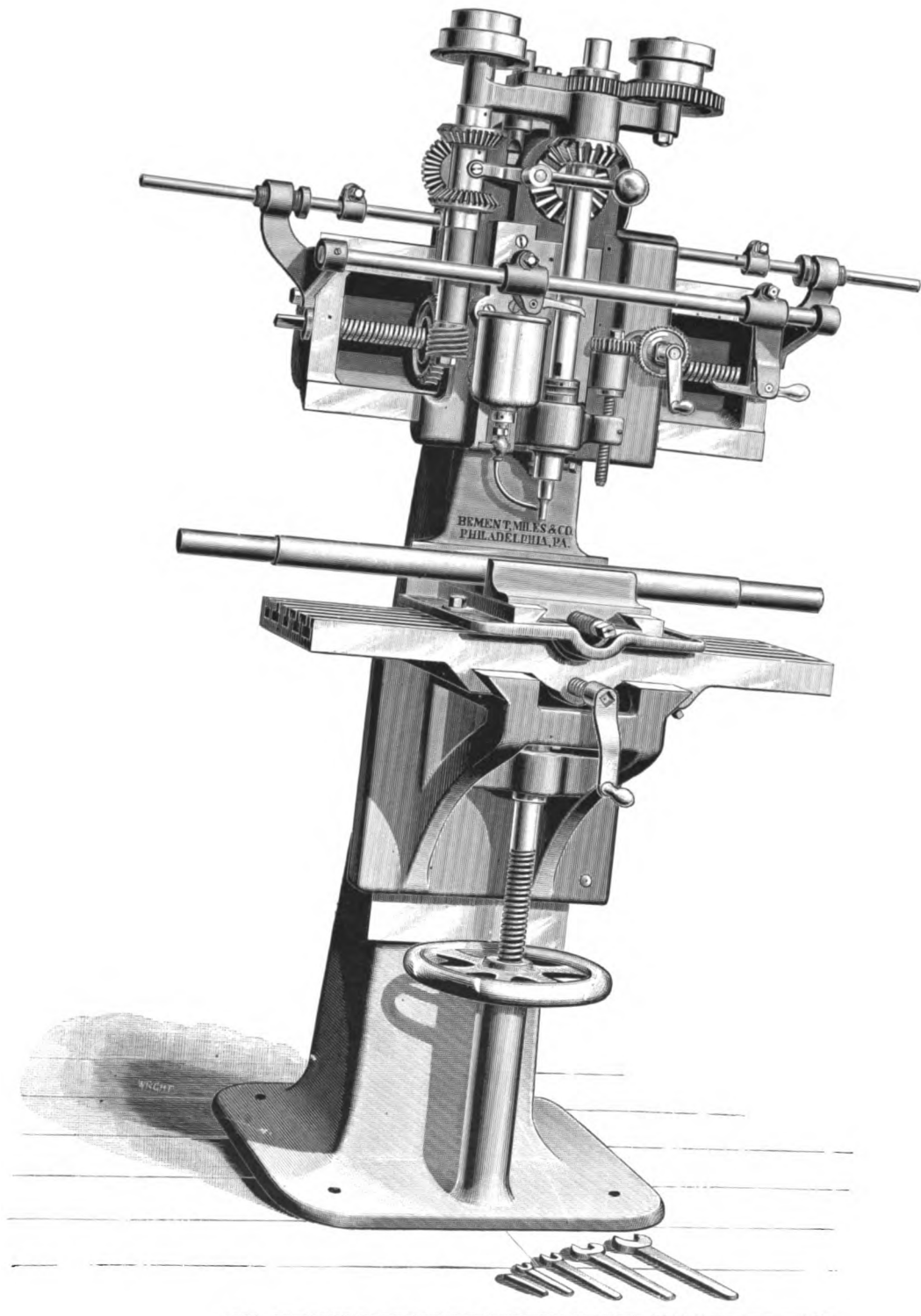
Distance from centre of column to end of arm, 108 inches; greatest capacity from spindle to table, 52 inches, and from spindle to base plate, 78 inches. Spindle can be swivelled on its saddle; has eight speeds by cone and gearing, 22 inches vertical traverse, six automatic feeds suitably arranged for boring and drilling, rapid hand movements and lever counterweight. Radial arm can be rotated on its own axis by worm gear for angular drilling, and is raised and lowered by power through a distance of 42½ inches. Slotted table for holding work, and base plate at right angles on floor level. Countershaft and wrenches included. This machine is built in the same style as the 7-foot, of which we give an illustration.



SPECIAL POST DRILLING MACHINE.

SPECIAL POST DRILLING MACHINE.

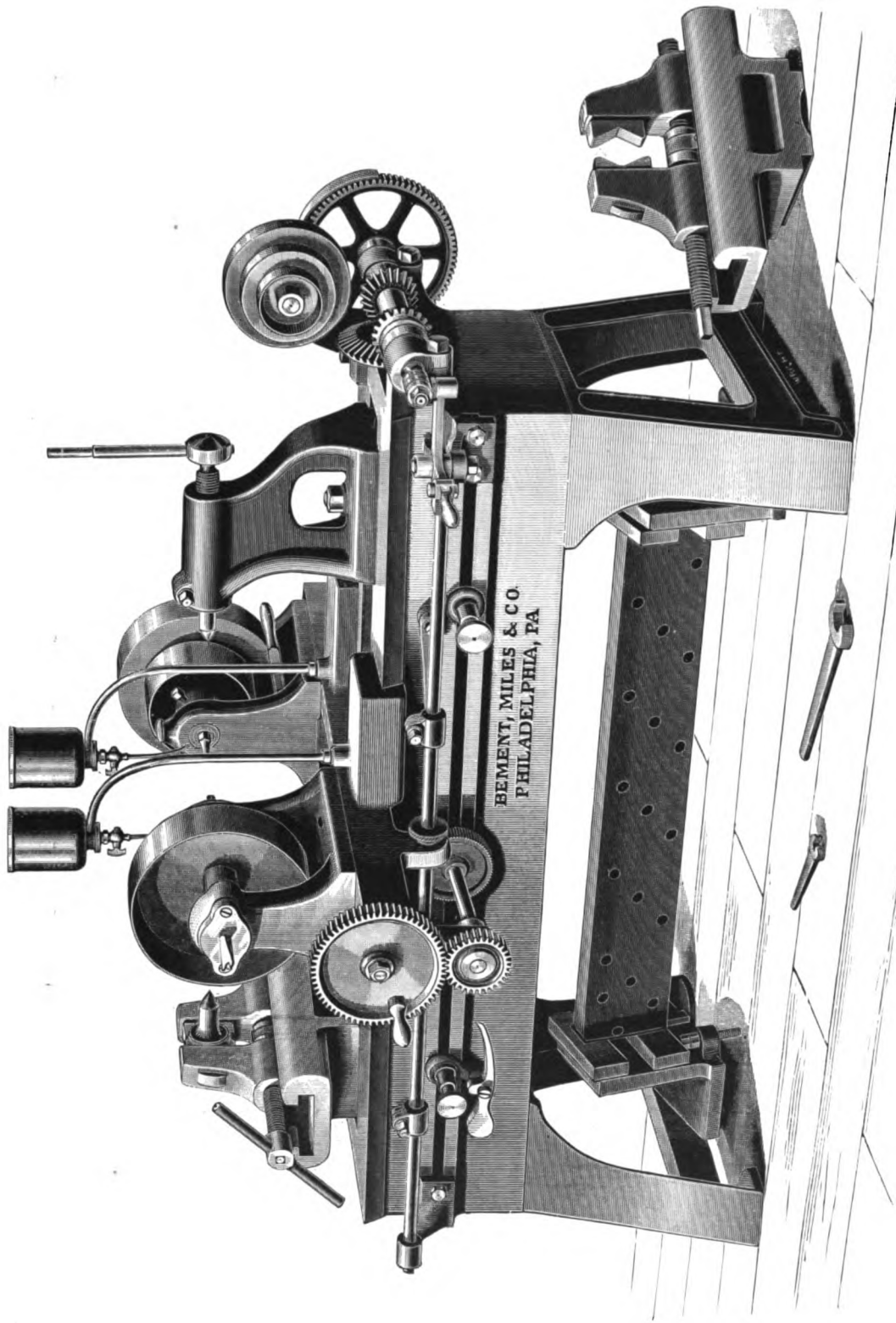
Consists of a fixed post supporting a counterbalanced arm, having a vertical adjustment of 5 feet 2 inches. The spindle has eight speeds by cone and gearing, three automatic feeds, 20 inches traverse, rapid hand motion, counterweight, and a rapid hand adjustment along the arm through a distance of 48 inches. The arm may be rotated on its axis, permitting the drilling of holes at any angle. Countershaft and wrenches included.



No. 1 COTTER AND KEYSEAT DRILLING MACHINE.

No. 1 COTTER AND KEYSEAT DRILLING MACHINE.

For drilling and mortising at one operation keyseats in shafts, etc. Drill has a movement of 12 inches longitudinally, and $2\frac{1}{2}$ inches vertically, travels automatically, is adjustable to any position or length of slot, and is self-reversing by clutch. Variable self-feed; adjustable table with slots for holding work. Clamping vise, countershaft and wrenches included.



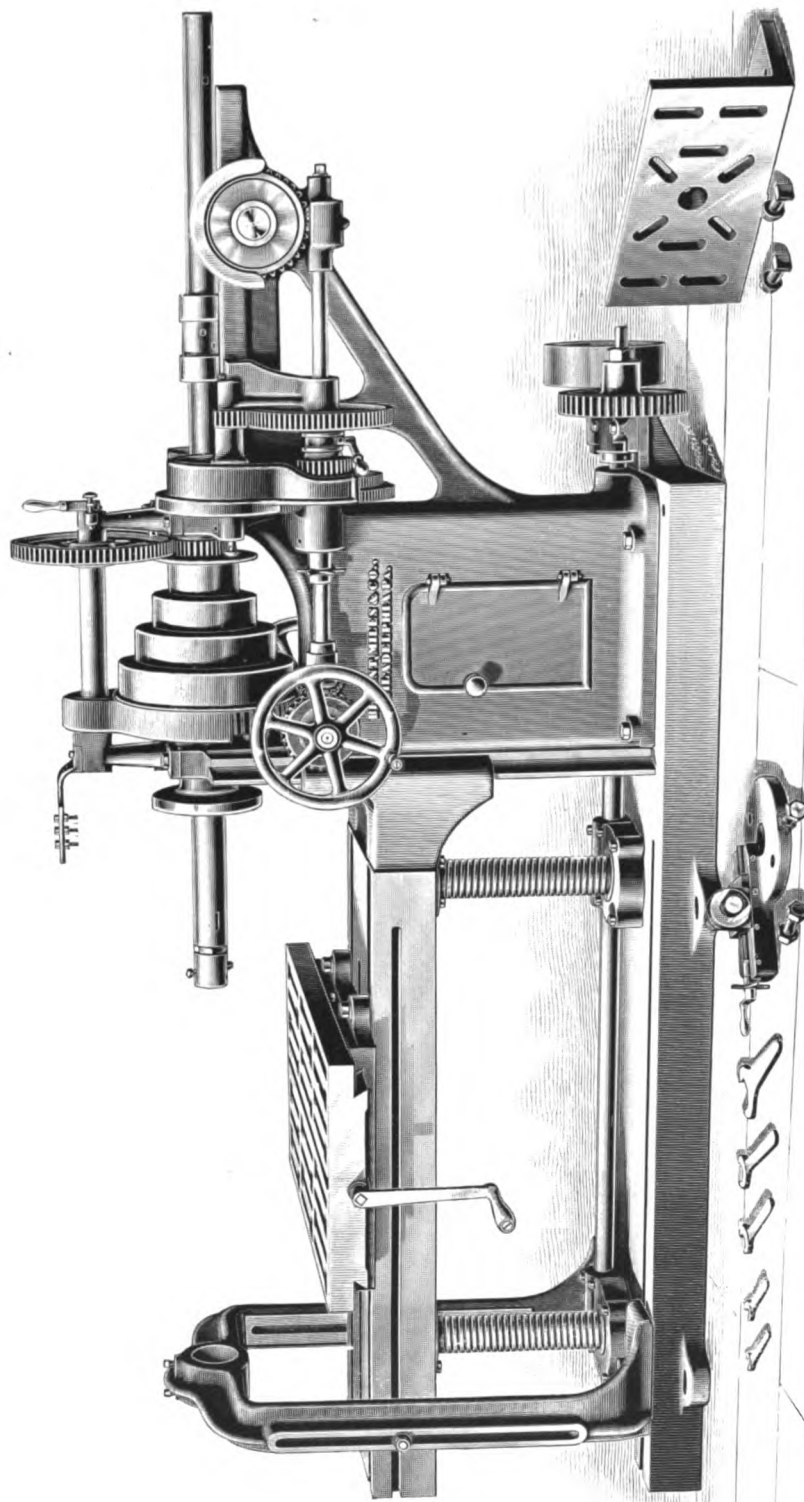
No. 2 COTTER AND KEYSEAT DRILLING MACHINE.

No. 2 COTTER AND KEYSEAT DRILLING MACHINE.

For drilling and mortising, at one operation, holes in stub ends, keyseats in shafts, slots, etc. Each drill has a movement of 36 inches longitudinally and 10 inches transversely, and can be accurately adjusted to any position or length of slot by sliding collars and screws. Feed is self-acting in all directions, with three changes, self-reversing by clutch, and has an automatic stop for limiting the depth of slot. The self-centring jaws will admit a 7-inch shaft; they are also provided with centres. Includes an adjustable table for work, which cannot be supported in centres or jaws, an oscillating countershaft, wrenches, and a sample pair of double-ended drills.

No. 3 COTTER AND KEYSEAT DRILLING MACHINE.

For drilling and mortising, at one operation, holes in stub ends, keyseats in shafts, slots, etc. Each drill has a movement of 36 inches longitudinally, and 16 inches transversely, and can be accurately adjusted to any position, or length of slot, by sliding collars and screws. Feed is self-acting in all directions, with three changes, self-reversing by clutch and has an automatic stop for limiting the depth of slot, as well as preventing the two drills from coming in contact. The self-centring jaws are large enough to admit an 18-inch shaft, and are also adapted for carrying centres. An adjustable table is provided for work not conveniently held in jaws or centres. Countershaft and wrenches included.



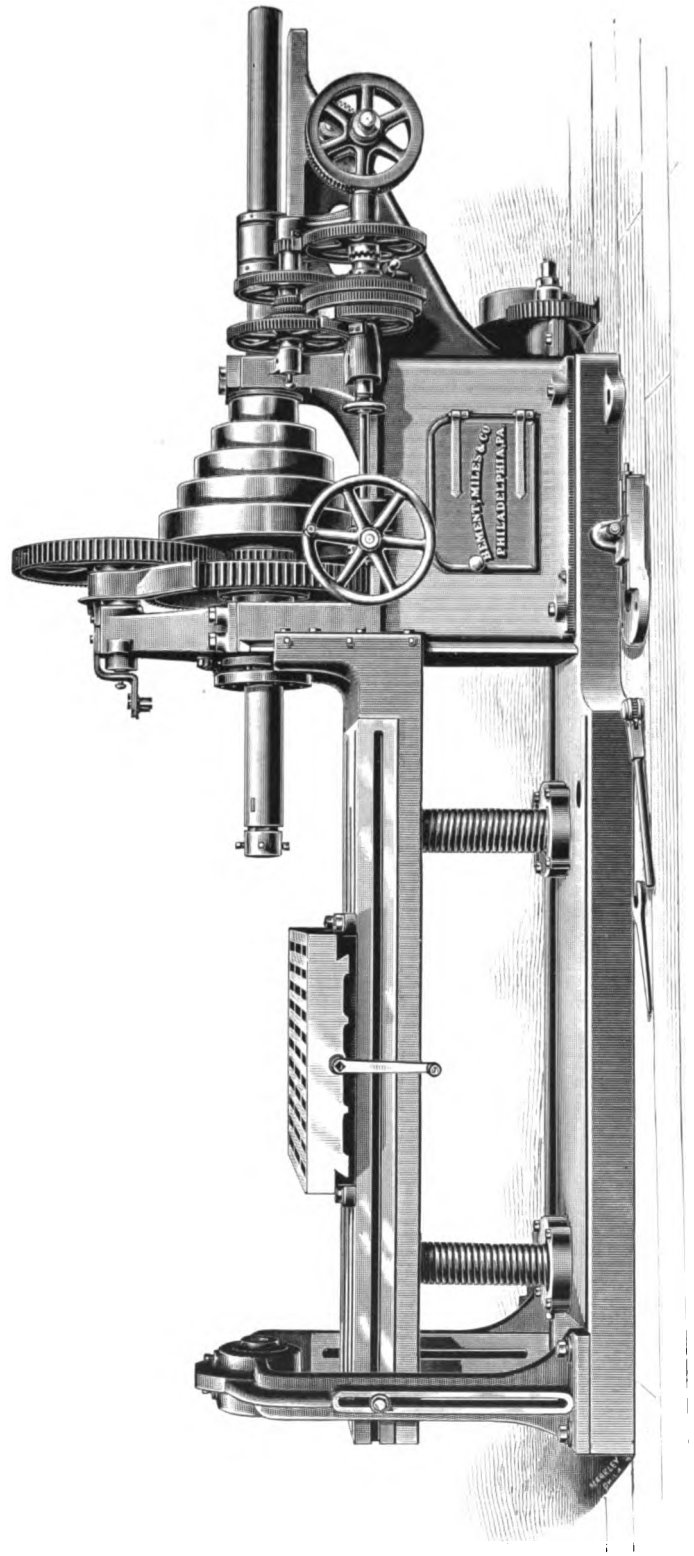
No. 2 HORIZONTAL BORING AND DRILLING MACHINE.

No. 1 HORIZONTAL BORING AND DRILLING MACHINE.

Capable of drilling or boring in the centre of a circle 54 inches in diameter. Spindle has a traverse of 18 inches to 36 inches, as desired, eight changes of speed in either direction, and four instantly changeable automatic feeds, suited to the various requirements of drilling and boring. The automatic feeds, as well as the slow and rapid hand movements of spindle, are all controlled from a position most convenient to the workman, and can be operated with equal facility on either side of the machine. Revolving sleeve, surrounding the spindle, has a face plate to which a head for facing may be attached. The main table, which is 4 feet long, is raised and lowered by means of connected screws and gearing, and supports a saddle with transverse table having movements at right angles by screws. When so ordered, a circular table will be added, also screw-cutting attachments. Outer end of boring bar is supported by an adjustable yoke, which also affords additional stiffness to the table and can be removed when desired. Self-feeding facing head, countershaft and wrenches included.

No. 2 HORIZONTAL BORING AND DRILLING MACHINE.

Capable of drilling or boring in the centre of a circle 61 inches in diameter. Spindle has a traverse of 24 to 48 inches, as desired, eight changes of speed in either direction, and four instantly changeable automatic feeds, suited to the various requirements of drilling and boring. The automatic feeds, as well as the slow and rapid hand movements of spindle, are all controlled from a position most convenient to the workman, and can be operated with equal facility on either side of the machine. Revolving sleeve, surrounding the spindle, has a face plate to which a slide rest for facing may be attached. The main table, which is 6 or 8 feet long, as desired, is raised and lowered by power by means of connected screws and gearing, and supports a saddle with transverse table having movements at right angles by screws. When so ordered, a circular table will be added, also screw-cutting attachments. Outer end of boring bar is supported by an adjustable yoke, which also affords additional stiffness to the table and can be removed when desired. Self-feeding facing rest, countershaft and wrenches included.



No. 4 HORIZONTAL BORING AND DRILLING MACHINE.
For description, see page 194.

No. 3 HORIZONTAL BORING AND DRILLING MACHINE.

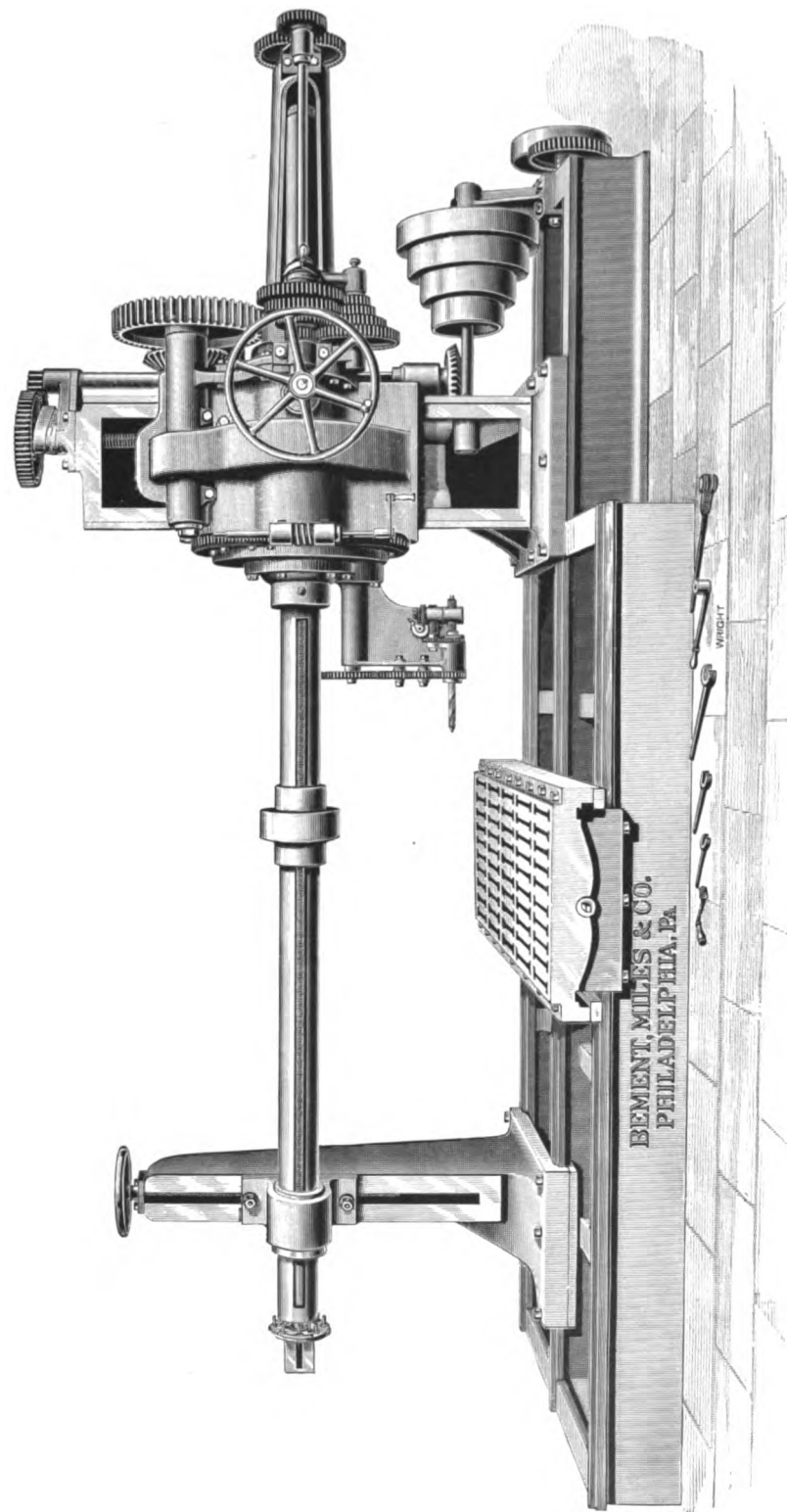
Capable of drilling or boring in the centre of a circle 65 inches in diameter. Spindle has a traverse of 28 to 56 inches, as desired; eight changes of speed in either direction, and six instantly changeable automatic feeds, suited to the various requirements of drilling and boring. The automatic feeds, as well as the slow and rapid hand movements of spindle, are all controlled from a position most convenient to the workman, and can be operated with equal facility on either side of the machine. Revolving sleeve, surrounding the spindle, has a face plate to which a slide rest for facing may be attached. The main table, which is 6 to 9 feet long, as desired, is raised and lowered by power through the connected supporting screws, and is provided with a saddle with transverse table having movements at right angles by screws. When so ordered, a circular table will be added, also screw-cutting attachments. Outer end of boring bar is supported by an adjustable yoke, which also affords additional stiffness to the table and can be removed when desired. Self-feeding facing rest, countershaft and wrenches included.

No. 4 HORIZONTAL BORING AND DRILLING MACHINE.

Capable of drilling or boring in the centre of a circle 67 inches in diameter. Spindle has a traverse of 60 inches; ten changes of speed in either direction and six instantly changeable automatic feeds, suited to the various requirements of drilling and boring. The automatic feeds, as well as the slow and rapid hand movements of spindle, are all controlled from a position most convenient to the workman, and can be operated with equal facility on either side of the machine. Revolving sleeve, surrounding the spindle, has a face plate to which a slide rest for facing may be attached. The main table, which is usually 9 feet long, is raised and lowered by power through the connected supporting screws, and is provided with a saddle with transverse table having movements at right angles by screws. When so ordered, a circular table will be added, also screw-cutting attachments. Outer end of boring bar is supported by an adjustable yoke, which also affords additional stiffness to the table and can be removed when desired. Self-feeding facing rest, countershaft and wrenches included.

No. 5 HORIZONTAL BORING AND DRILLING MACHINE.

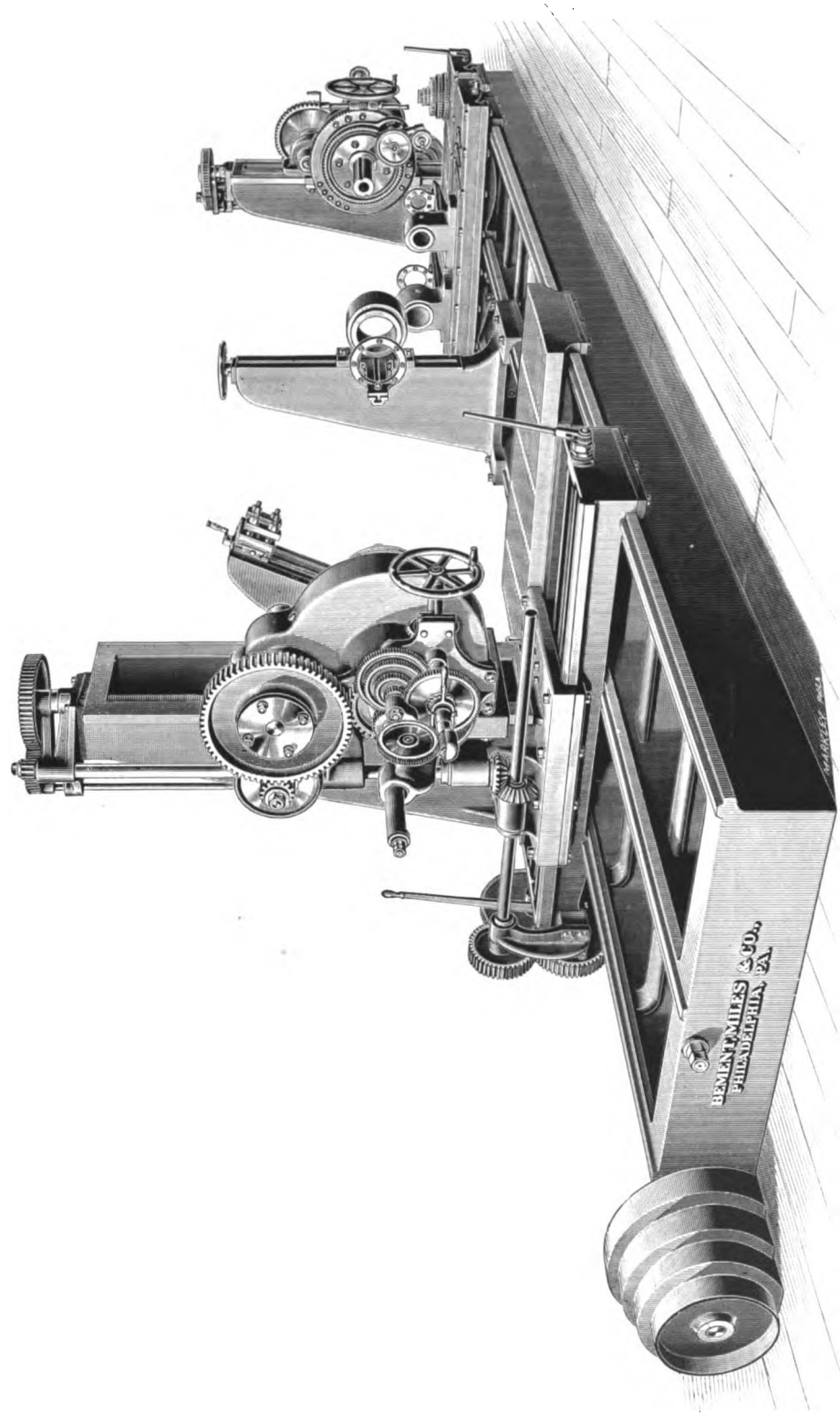
Capable of drilling or boring in the centre of an 80-inch circle. Spindle is 7 inches in diameter, and has an extreme traverse of 72 inches. The power is applied by a large and wide-faced cone of five steps, triple geared to an internal face plate, giving fifteen changes of speed in either direction. To the face plate, which is attached to a sleeve surrounding the spindle, may be applied a slide rest, having four automatic feeds for facing any diameter up to 80 inches. The automatic feeds for spindle are six in number, specially arranged for the various requirements of drilling and boring. These feeds, as well as the slow and rapid hand movements of spindle, are all controlled from a position most convenient to the workman, and can be operated with equal facility on either side of the machine. The main table, which is usually 12 feet long, is raised and lowered by power through the connected supporting screws, and is provided by a saddle with transverse table, having movements at right angles by screws. If desired, power can be applied to the transverse movement of upper table. A circular table, rotated by worm, worm wheel, etc., will be added, if required. Outer end of boring bar is supported by an adjustable yoke, which also affords additional stiffness to the table, and can be removed when desired. The feeding arrangement may be so constructed that screws of any pitch can be correctly cut. Self-feeding facing rest, countershaft and wrenches included.



No. 6 HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

No. 6 HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

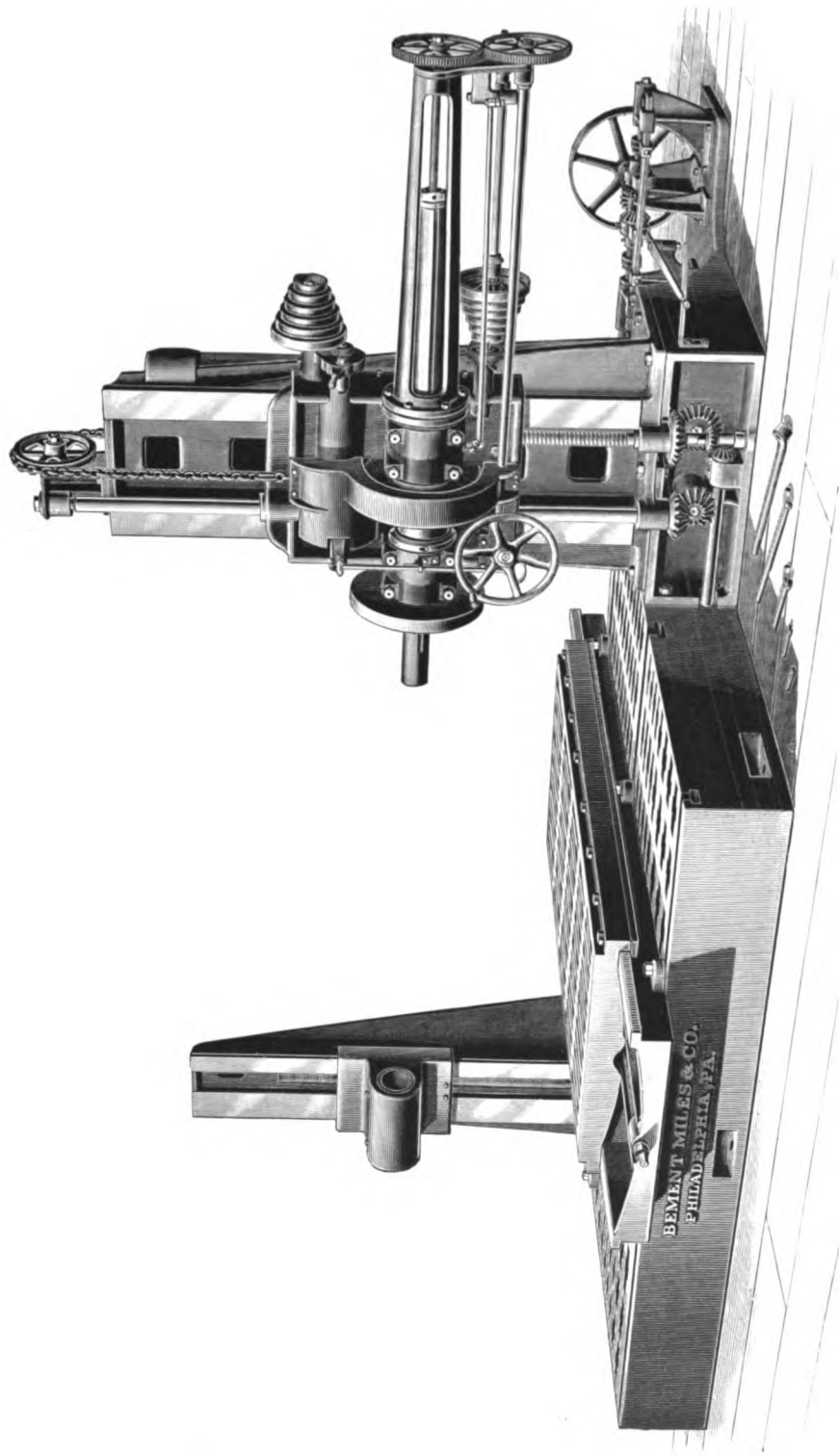
For boring, facing and drilling engine cylinders, frames, etc. The bed may be of any desired length. The work rests upon a table having movements at right angles, and the saddle has a self-acting vertical adjustment on upright to a position high enough to bore to the centre of 10 feet. Boring spindle is 8 inches in diameter, revolving in a flanged sleeve to which boring bars of any required size may be attached. It has a traverse of 48 inches, eight changes of speed, variable automatic boring feeds and rapid hand movement. Outer end of boring bars supported by substantial post traversed on bed by power, and raised and lowered by screw. Attached to the saddle is a radial arm for drilling bolt holes in flanges of cylinders of any diameter from 78 inches down to 12 inches, with index arrangement for accurate spacing of the holes in a circle. Includes two countershafts with the necessary wrenches.



No. 6 HORIZONTAL BORING, DRILLING AND MILLING MACHINE—SPECIAL.

No. 6 HORIZONTAL BORING, DRILLING AND MILLING MACHINE—SPECIAL.

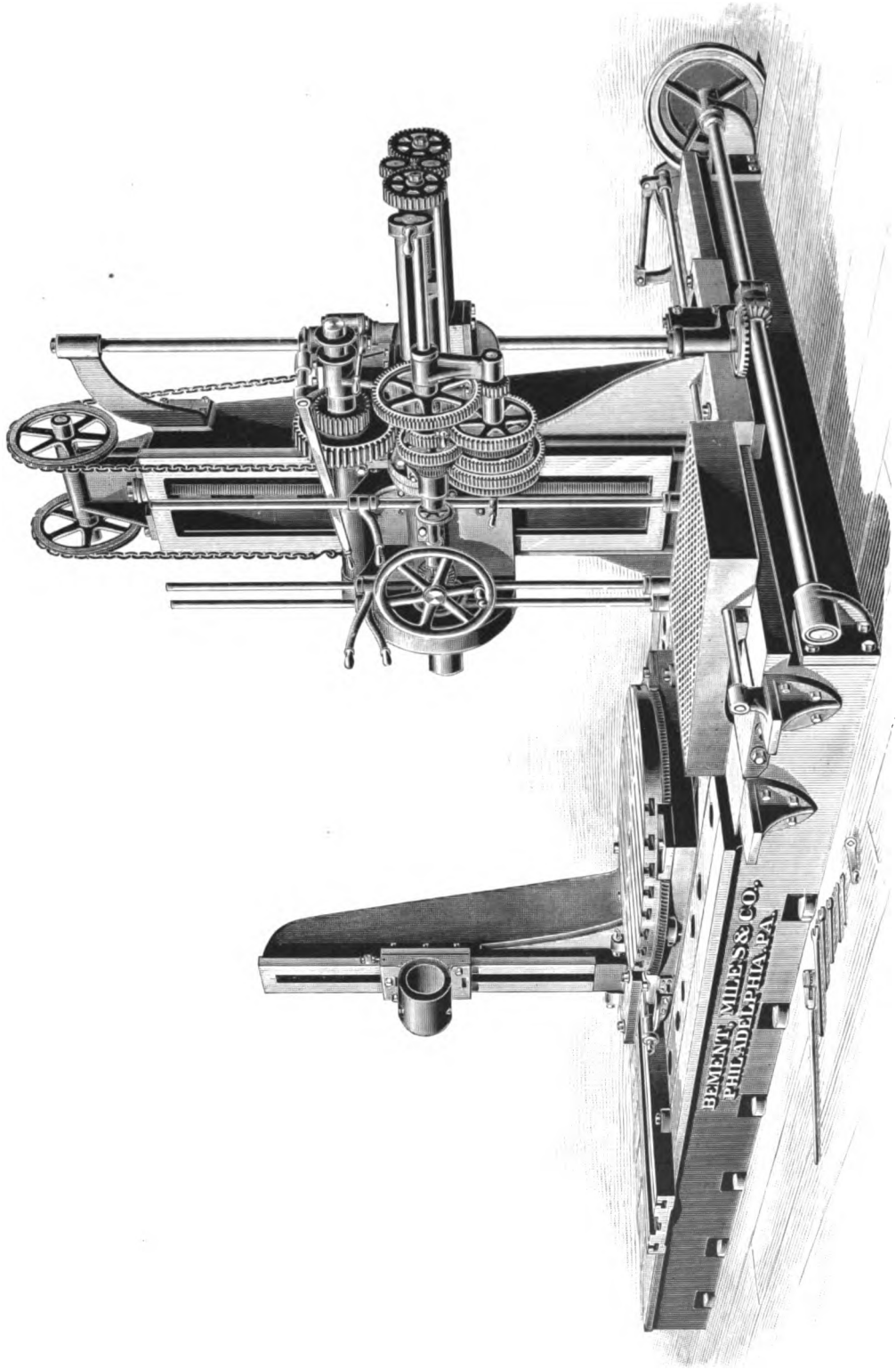
The illustration on the opposite page represents a machine similar to the preceding one, but with some additional parts, particularly a second table and a post with a saddle, having vertical and transverse adjustments with a spindle for drilling, as well as a rest for facing large diameters. So constructed, it will bore and face both ends of a large cylinder at one time. A circular table may be added, if desired. This machine may be modified to suit various requirements.



No. 7 HORIZONTAL BORING, DRILLING, TAPPING AND MILLING MACHINE.

No. 7 HORIZONTAL DRILLING, BORING, TAPPING AND MILLING MACHINE.

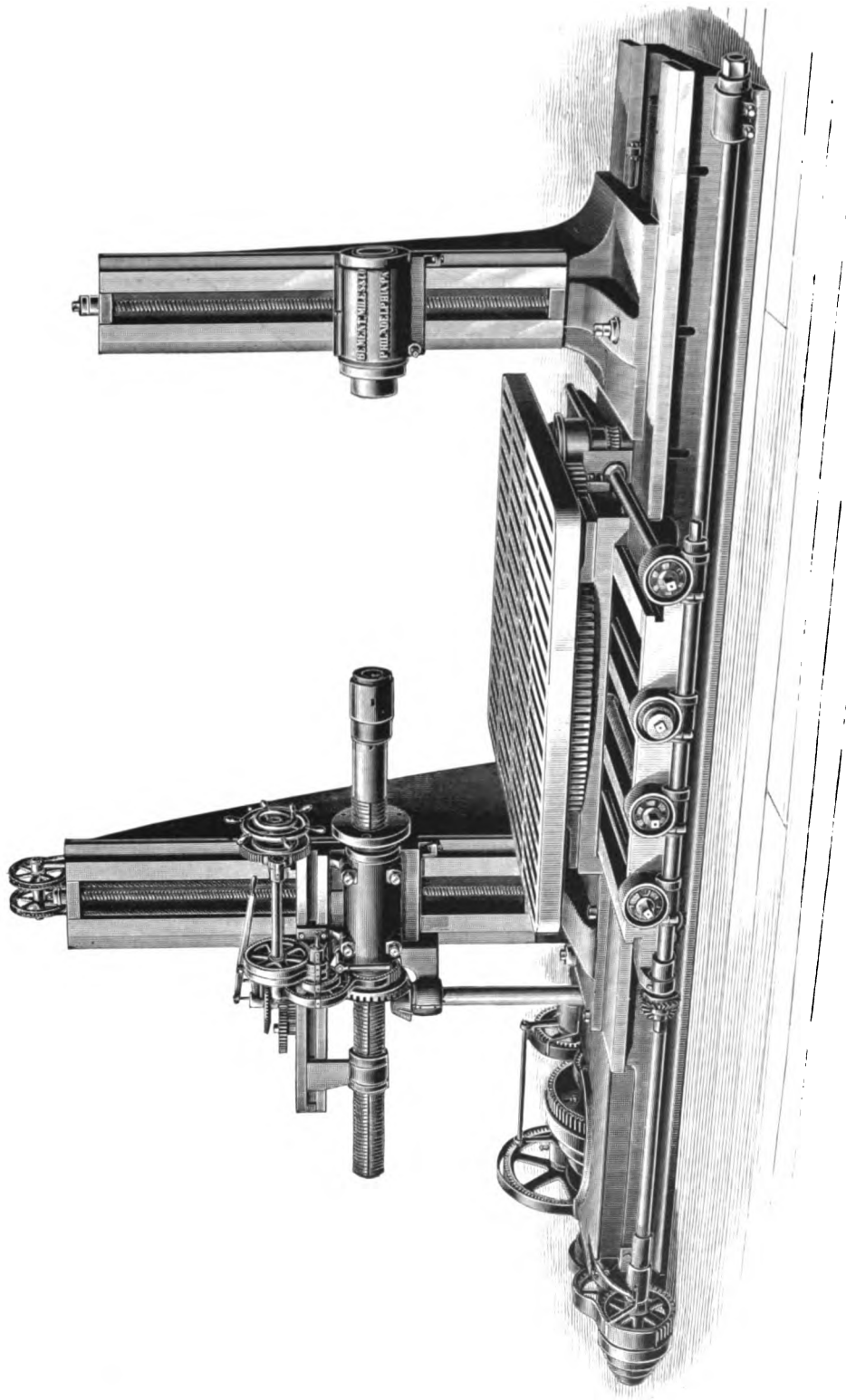
Bed 12 feet long by 9 feet 10 inches wide. The main post is fixed in position and supports a counterbalanced saddle, having a vertical adjustment of 54 inches. Spindle has a traverse of 48 inches, rapid motion in either direction by hand, sixteen changes of speed and twelve automatic feeds. The work is supported on a table 8 feet 8 inches long by 48 inches wide, having a transverse adjustment by power of 10 feet 7 inches. The main saddle and outer bearing for boring bar are raised and lowered together by power through connected gearing, and the outer post is adjustable along the bed by hand through a screw, etc. Countershaft and wrenches included.



No. 8 HORIZONTAL BORING, DRILLING, TAPPING, STUD INSERTING AND MILLING MACHINE.

No. 8 HORIZONTAL BORING, DRILLING, TAPPING, STUD INSERTING AND MILLING MACHINE.

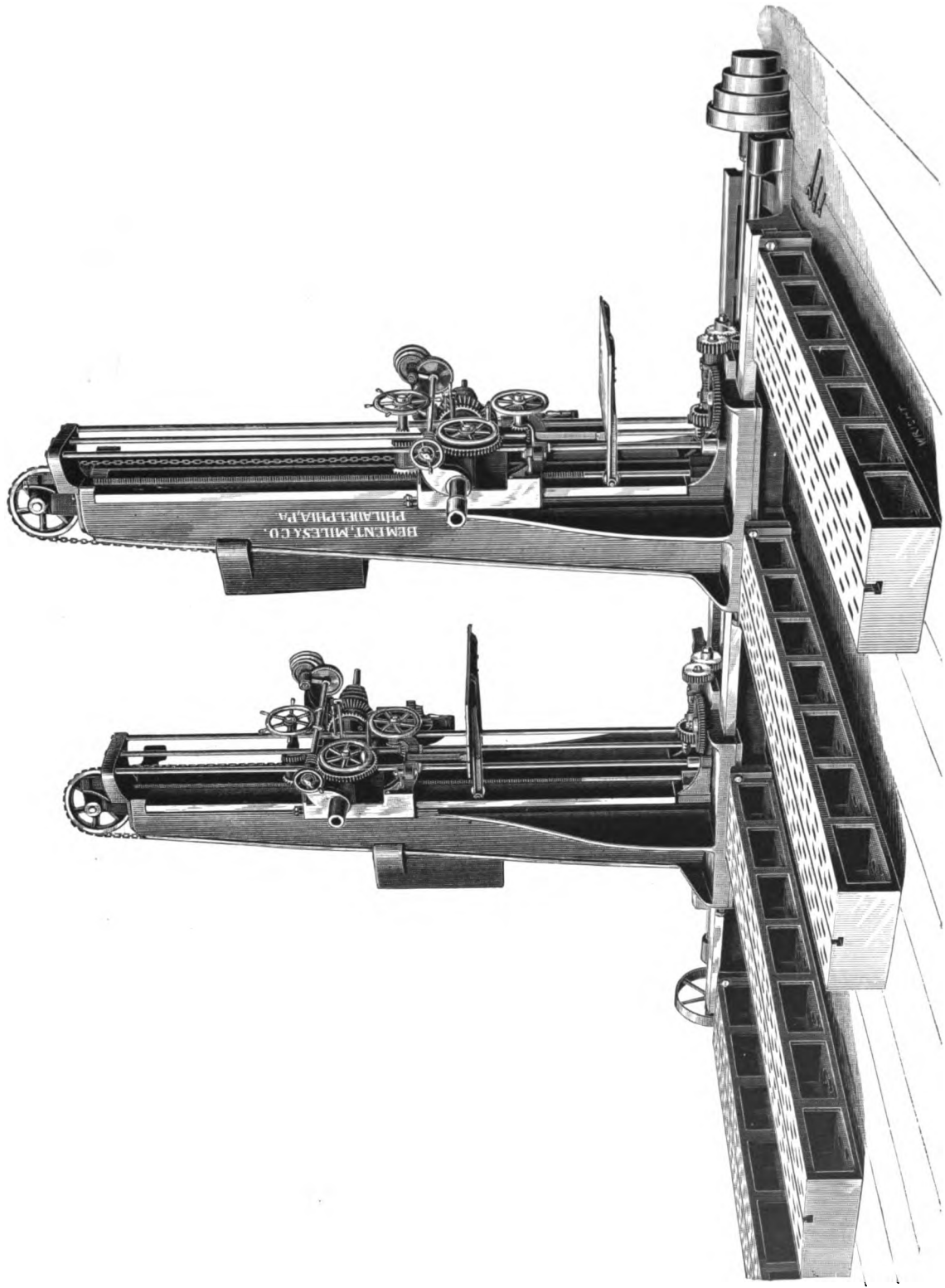
Usual size of work table 10 feet by 20 feet, and diameter of circular table, if required, 6 feet. Length of bed 15 feet, and traverse of post 10 feet. Vertical movement of saddle, 6 feet, 8 feet, or 10 feet, as may be ordered. Spindle has a traverse of 4 feet with rapid motion in either direction by hand, sixteen changes of speed and three automatic feeds. The saddle traverses vertically on column, and post horizontally on bed by power, with a slow or rapid rate of speed. The saddle is counter-balanced. There is also an attachment for traverse of post, with three changes of self-acting feed, for milling. All the motions of the spindle, saddle and post are controlled by levers from a position most convenient for the operator. A post for out-board bearing with horizontal motions at right angles, as well as vertical adjustment of the saddle, is also provided. Countershaft and wrenches included.



No. 10 HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

No. 10 HORIZONTAL BORING, DRILLING, AND MILLING MACHINE.

The bed may be made of any desired length. Boring spindle has a traverse of 86 inches, twelve speeds, six automatic feeds and rapid hand movement; it also has a vertical adjustment of 96 inches, together with the outer support for boring bar, by connected gearing. Table has circular and right-angled movements, all by power. Transverse adjustment of tables, 95½ inches. Post for supporting outer bearing is adjustable lengthwise on bed. Countershaft and wrenches included.



No. 3 DRILLING, TAPPING AND STUD INSERTING MACHINE.

No. 2 DRILLING, TAPPING AND STUD INSERTING MACHINE.

Can be constructed with one or two posts, as required. Usual length of bed 10 feet 6 inches, giving a horizontal movement of post of 6 feet. Size of work table, 10 feet 6 inches by 60 inches. Spindle has a vertical adjustment of 6 feet, a horizontal traverse of 15 inches, eight driving speeds which are instantly reversible, three automatic feeds, and rapid traverse by hand. All the power motions and feeds including the movement of post on its bed and saddle on post, are effected by levers from the platform attached to the saddle upon which the workman stands. Countershaft and wrenches included.

No. 3 DRILLING, TAPPING AND STUD INSERTING MACHINE.

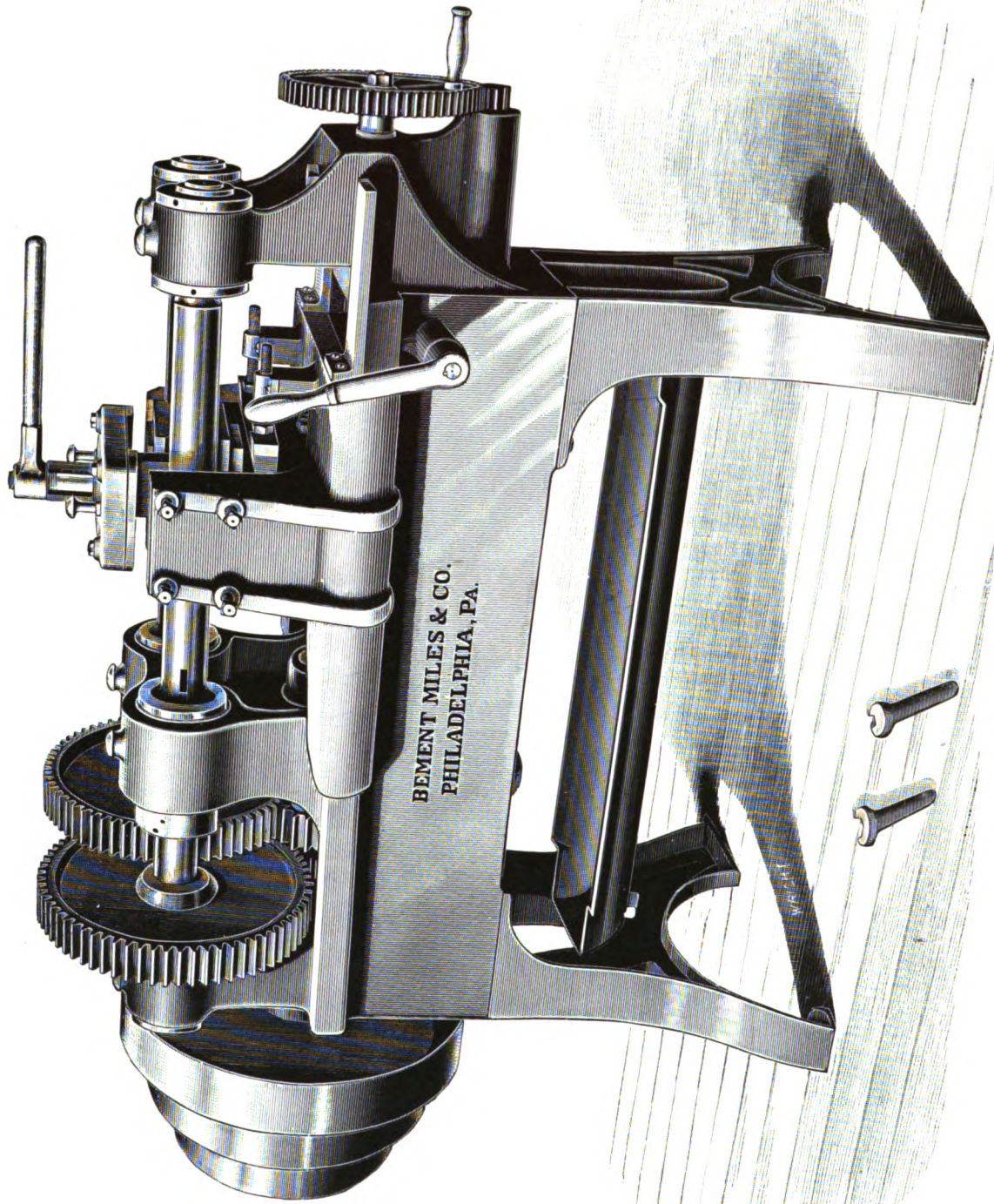
Can be constructed with one or two posts, as required. Usual length of bed 15 feet, giving a horizontal movement of post of 10 feet. Size of the four plates forming the work table, 12 feet by 2 feet each. Spindle has a vertical adjustment of 10 feet, a horizontal traverse of 24 inches, eight driving speeds which are instantly reversible, three automatic feeds, and rapid traverse by hand. All the power motions and feeds, including the movement of post on its bed and the saddle on the post, are effected by levers from the platform attached to the saddle upon which the workman stands. Countershaft and wrenches included.



UNIVERSAL HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

UNIVERSAL HORIZONTAL BORING, DRILLING AND MILLING MACHINE.

Boring spindle has twenty changes of speed and 3 feet traverse, with twelve automatic feeds, also hand movement. The counterbalanced saddle is movable vertically together with the opposite bearing for boring bars, to 5 feet above the table, and either with a slow movement of 1 inch or 6 inches per minute, or a rapid motion of 6 feet per minute. Table has a traverse of 10 feet by power in both directions, with slow movement of 1 inch or 6 inches and a quick motion of 6 feet per minute. All the movements required in working are controlled from one convenient position.



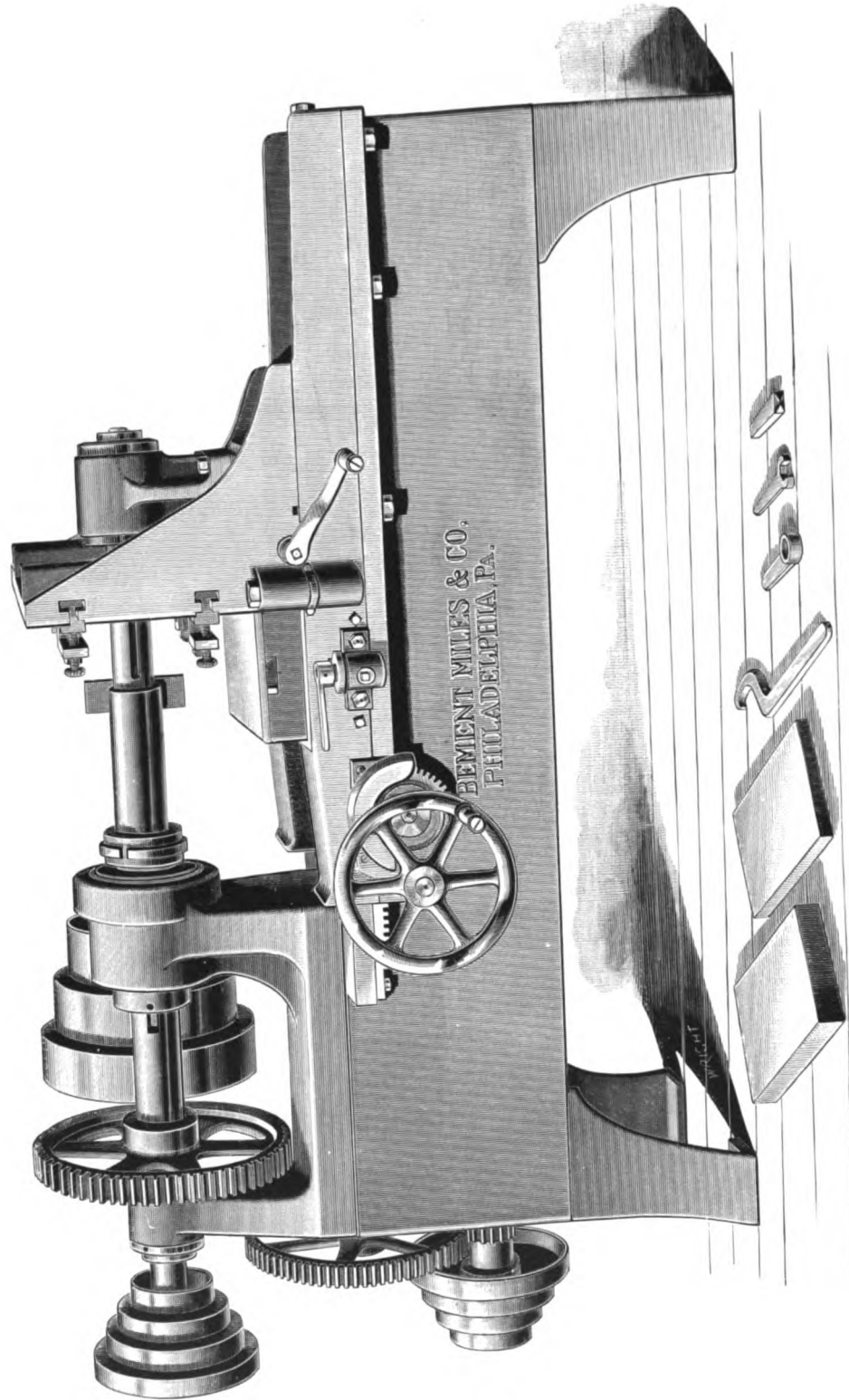
HEAVY DOUBLE BOX BORING MACHINE.

DOUBLE BOX BORING MACHINE.

Bed, 44 inches long. Driven by cone, with three changes for a 4-inch belt, geared into two steel cutter bars or spindles, each provided with cutters for boring and shouldering. Self and hand feeding. Saddle arranged to carry four boxes, with conveniences for vertical adjustment and rapid changing of same. Trough for catching chips. Countershaft and wrenches included.

HEAVY DOUBLE BOX BORING MACHINE.

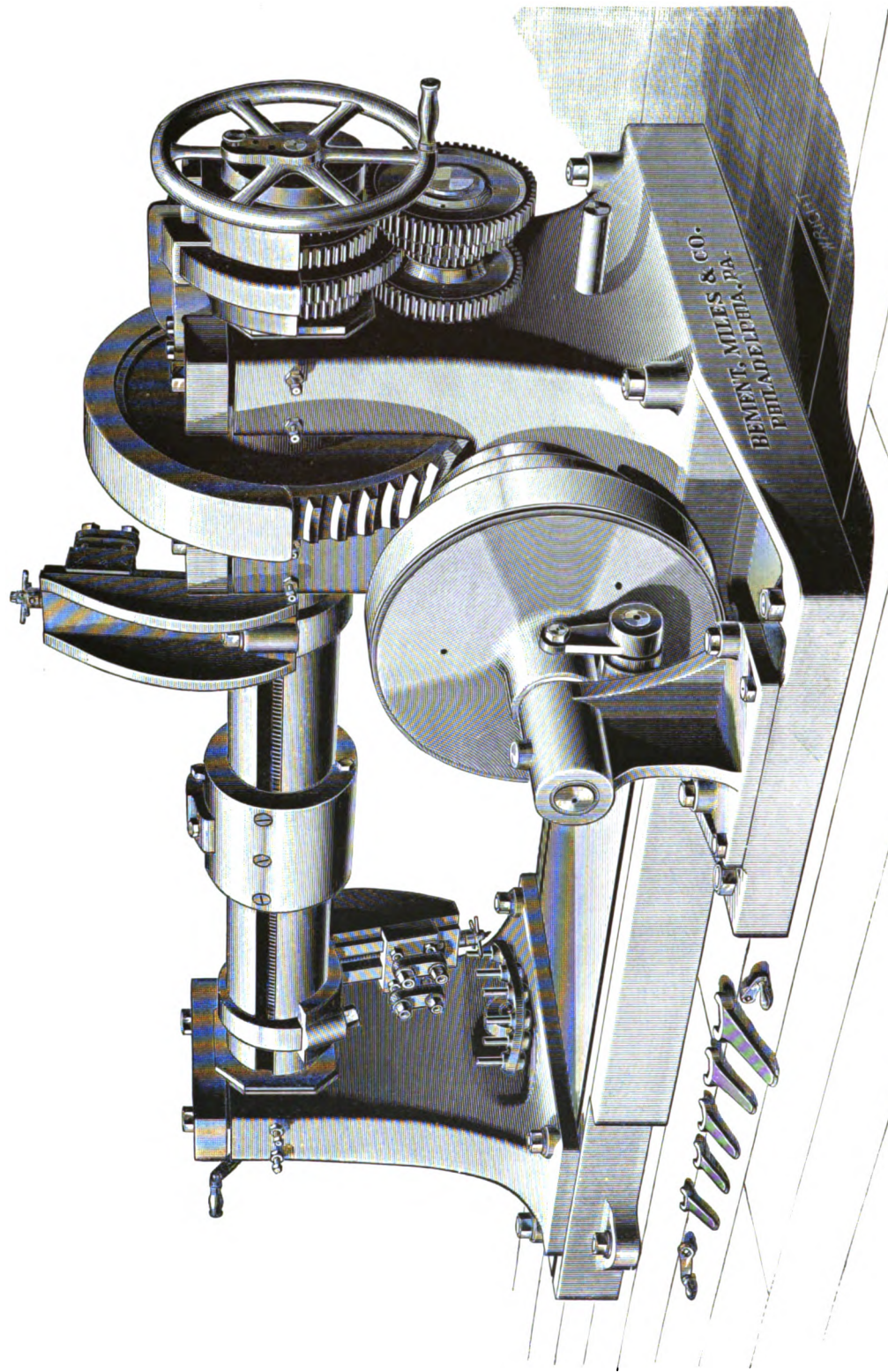
Driven by cone with three changes for a 4-inch belt. Boring spindles of steel, each having three bearings adjustable for wear, and provided with cutters for boring and shouldering. Self and hand feeding. Saddle arranged to carry four boxes, with conveniences for vertical adjustment and rapid changing of same. Trough for catching chips. Countershaft and wrenches included.



LOCOMOTIVE BOX BORING MACHINE.

LOCOMOTIVE BOX BORING MACHINE.

Has three driving speeds by cone and gearing, and four self-acting feeds to carriage, which also has a rapid hand motion by hand wheel, gearing and steel rack on bed. All the bearings of the spindle have an adjustment for wear. Suitable clamps for the boxes are provided with adjustments, both vertical and horizontal, for centring the castings. Length of bed, 76 inches. Includes countershaft and the necessary wrenches.



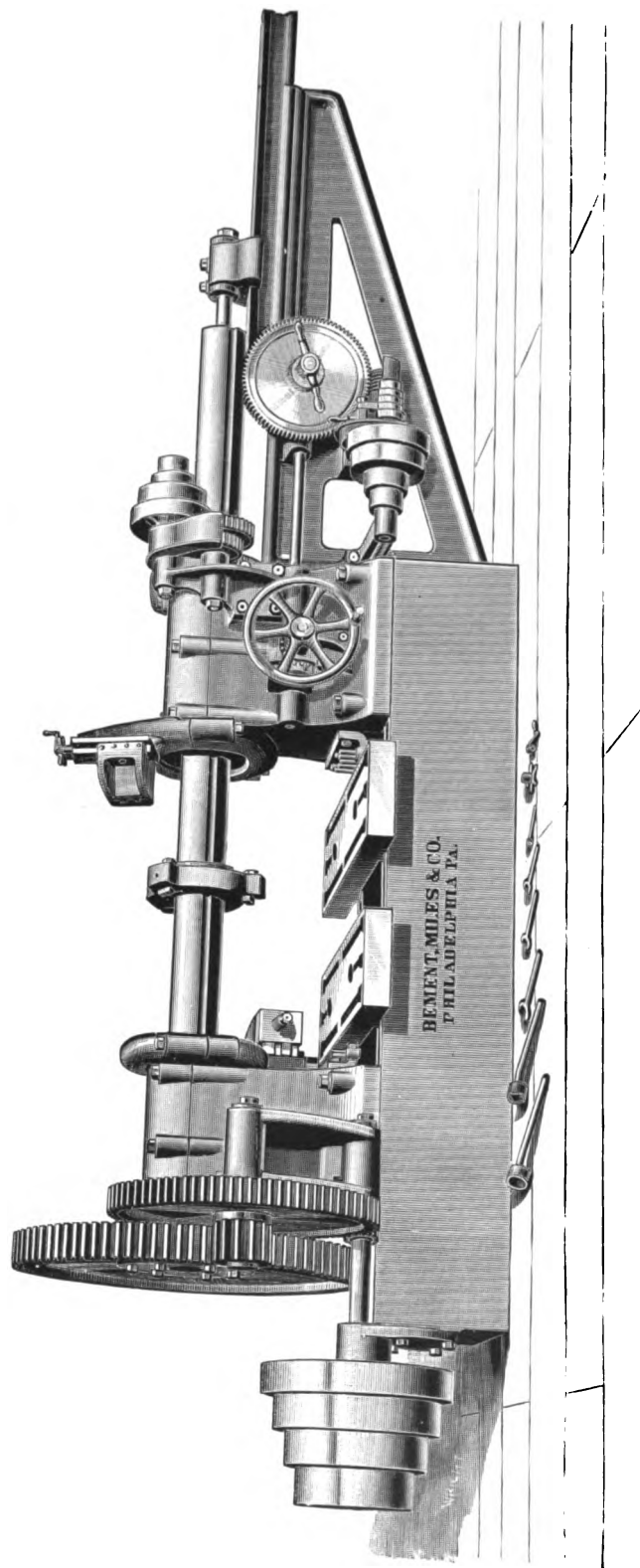
No. 2 LOCOMOTIVE CYLINDER BORING MACHINE.

No. 1 CYLINDER BORING MACHINE.

For small locomotive and other cylinders. Will bore 14 inches diameter by 24 inches long. Has four speeds, four self-acting feeds to boring bar and six to each facing head. It will bore and face both ends at one time, and the bar can be rapidly drawn through one head, across the intervening space and into the second head for convenience of removing the sinking head, or for the placing, or removal, of the cylinder. When the facing heads are not in use, they may be quickly disconnected and remain in a stationary position. Bar is of steel, 5 inches in diameter, and distance from its centre to table 16 inches. Includes countershaft and one boring head. Others can be made to order.

No. 2 LOCOMOTIVE CYLINDER BORING MACHINE.

Has four speeds, three self-acting feeds to boring bar, instantly changeable from roughing to finishing, and six feeds to facing heads. Will bore and face both ends of a cylinder at one time, and the facing rests will also answer for cutting off the sinking heads. Diameter of boring bar 9 inches, and distance from its centre to top of bed 26½ inches. Includes countershaft, etc.

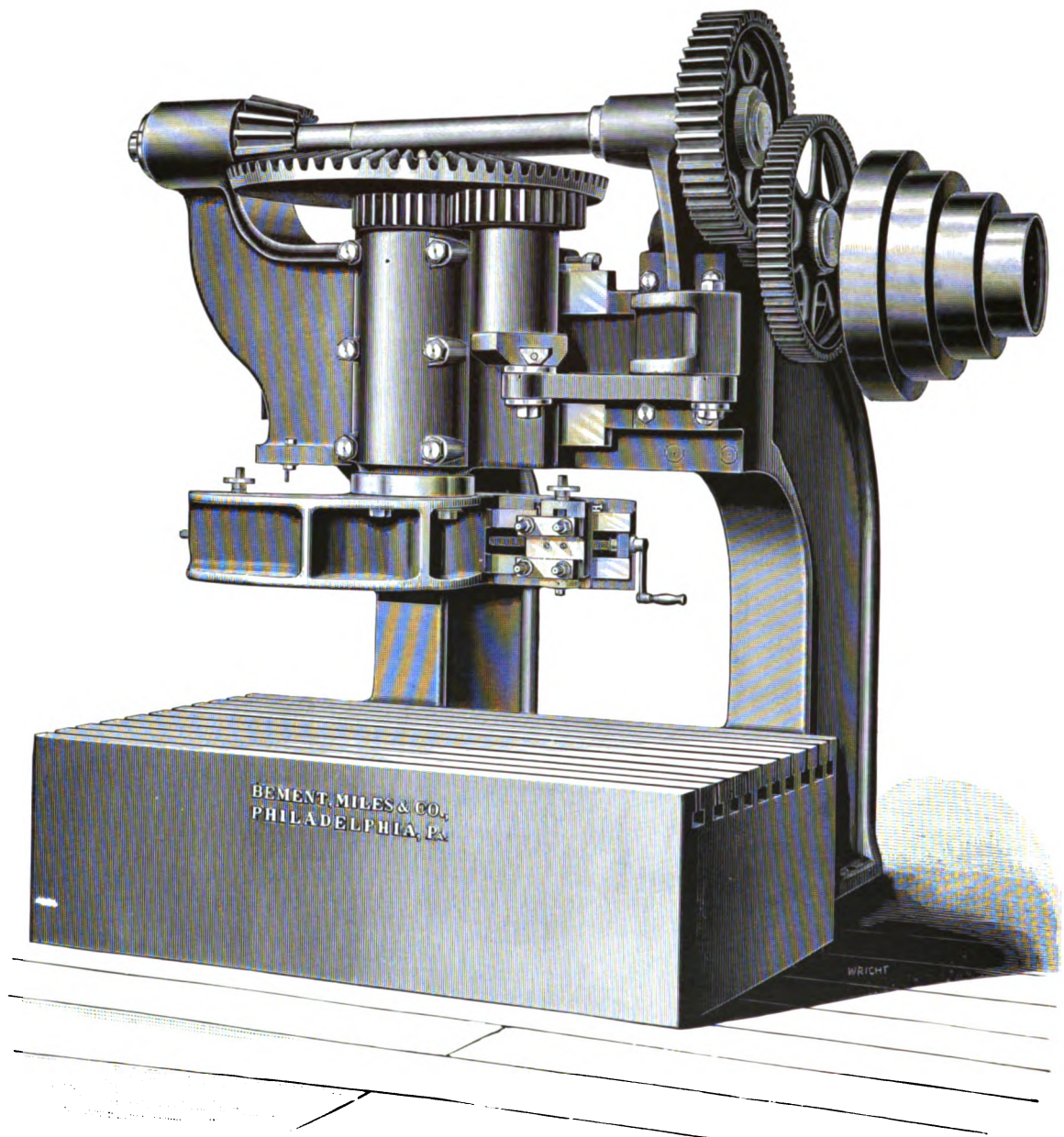


No. 3 LOCOMOTIVE CYLINDER BORING MACHINE.

No. 3 LOCOMOTIVE CYLINDER BORING MACHINE.

Has four speeds, four self-acting feeds to boring bar and six to each facing head. It will bore and face both ends at one time, and the bar can be rapidly drawn through one head, across the intervening space and into the second head for convenience of removing the sinking head, or for the placing or removal of the cylinder. When the facing heads are not in use, they may be disconnected and remain in a stationary position. Diameter of bar 7 inches, and distance from its centre to top of bed 24 inches.

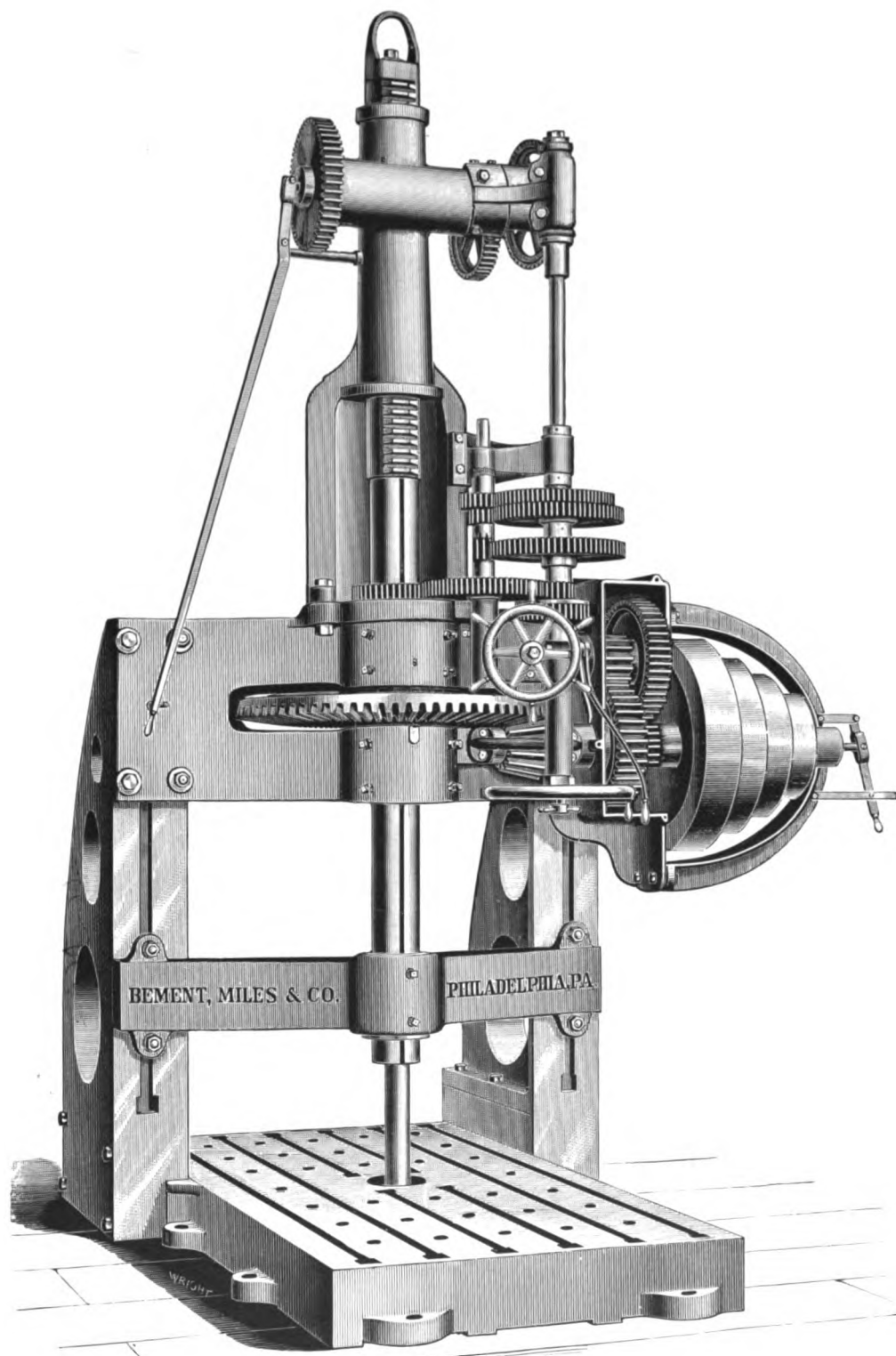
Unless otherwise ordered the machine is built for cylinders having an extreme length of not more than 36 inches.



MANHOLE BORING MACHINE.

MANHOLE BORING MACHINE.

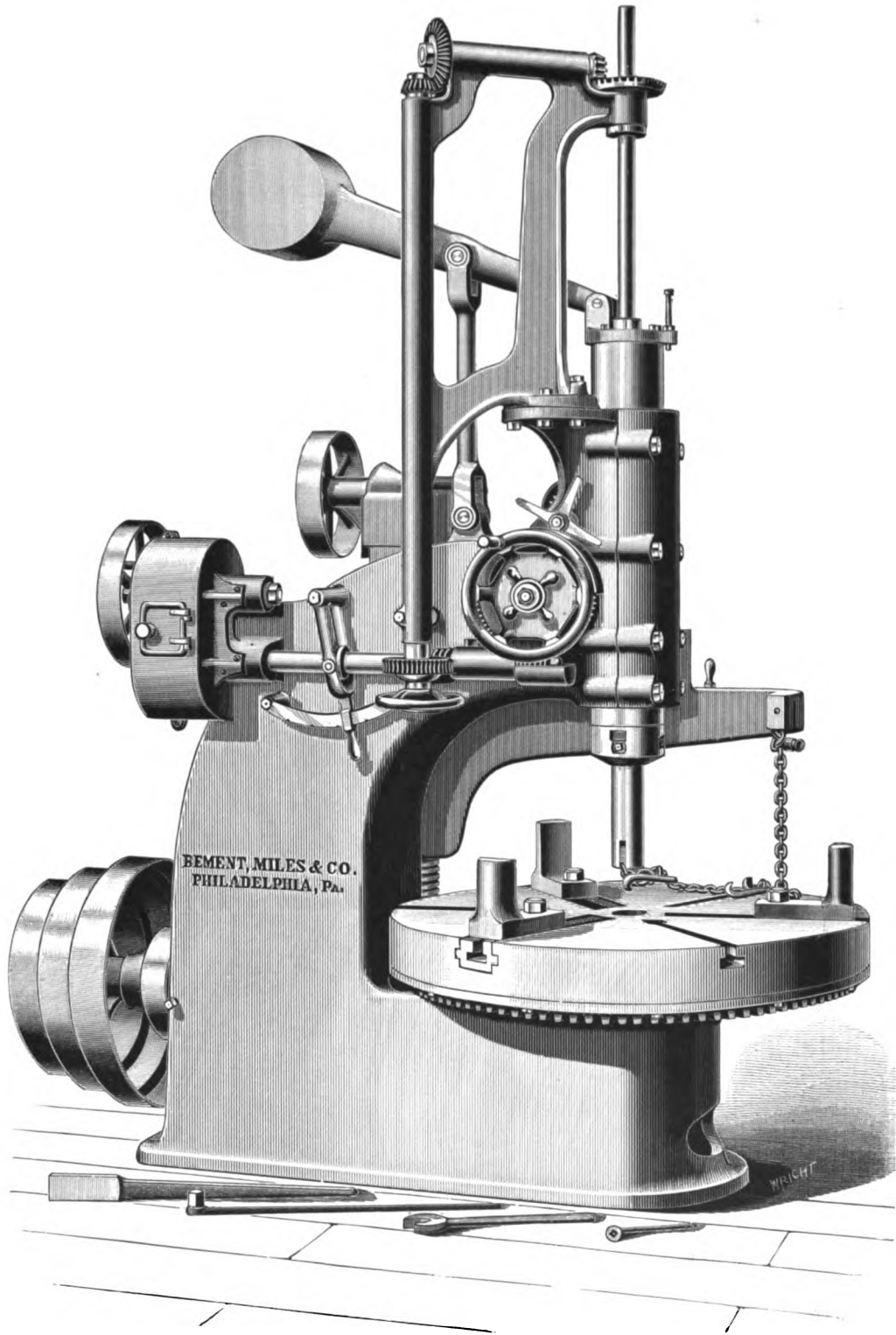
Driven by large cone of four steps, and powerfully geared to a spindle to which is attached a double ended slide rest. Will bore a round hole from 9 inches to 48 inches diameter, or an oblong hole with any difference between the length and width up to 12 inches. Overreach of spindle is 36 inches, and swing inside of uprights 48 inches. These dimensions can be increased, if desired. Work bed is 72 inches long by 60 inches wide, and distance from bed to cross slide is 30 inches. Countershaft and wrenches included.



HEAVY UPRIGHT BORING MACHINE.

HEAVY UPRIGHT BORING MACHINE.

For drilling and boring cranks and other heavy forgings. Length of bed 10 feet, width between uprights 5 feet, admitting a circular piece 5 feet 8 inches diameter, and height under cross head 5 feet. Spindle 8 inches in diameter, with 5 feet traverse, eight speeds, six changes of automatic feed, hand motion and quick return by power. A double facing head for turning hubs, also a double cutter head with annular knives, for boring out cores, furnished, if ordered. Countershaft and wrenches included.

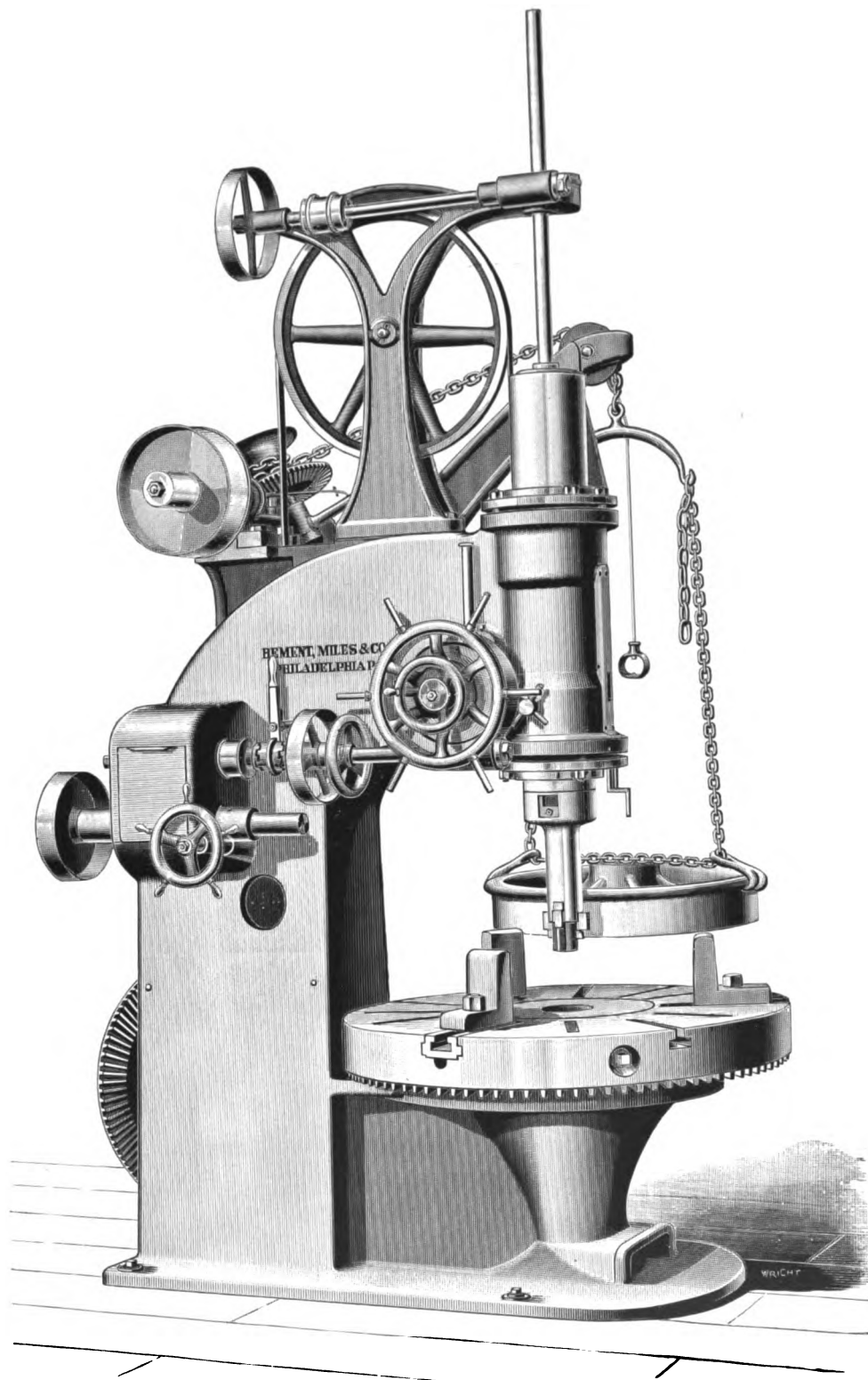


48-INCH WHEEL BORING MACHINE.

48-INCH WHEEL BORING MACHINE.

Swings 48 inches diameter. Table has six changes of speed so arranged that by shifting the belt, the roughing speed may be changed to a slower one for hard wheels, or vice versa. Chuck has three connected jaws, concentric and eccentric, capable of receiving a 42-inch wheel, and quickly adjustable to any diameter. Boring spindle has a traverse of 24 inches, four automatic feeds instantly changeable while running, rapid hand movement by rack and pinion, and lever counterbalance. Power crane attached for placing and removing the wheels. Countershaft, wrenches and one cutter mandrel included. Self-feeding hub-facing attachment applied, when required.

NOTE.—Since the illustration was made, we have changed the chuck in table to one of five jaws.

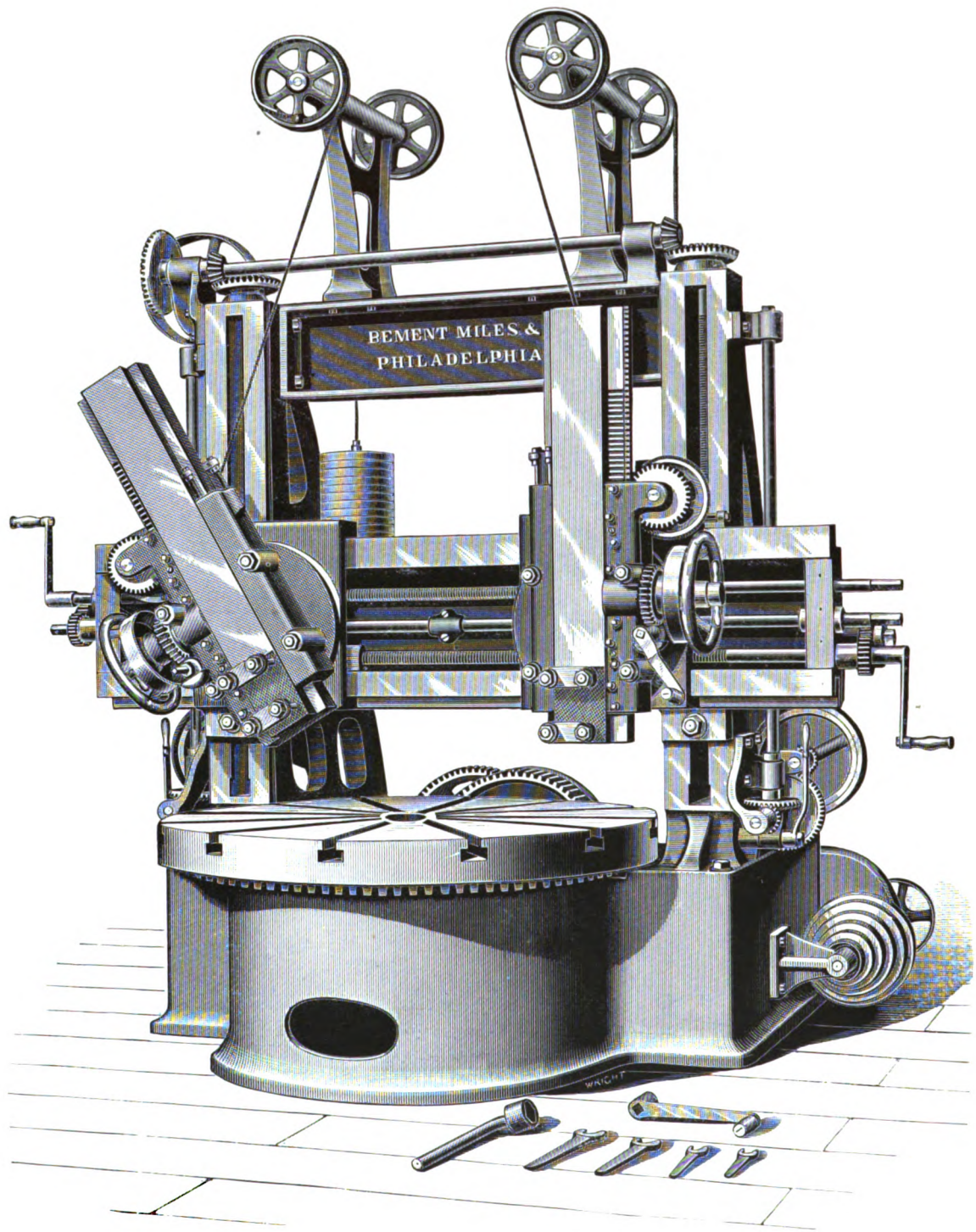


52-INCH WHEEL BORING MACHINE.

52-INCH WHEEL BORING MACHINE.

Swings 52 inches diameter. Table is double geared and has eight motions so arranged that, by moving the shifter bar, the roughing speed may be instantly changed to a slower one for hard wheels or hard spots, and vice versa. Chuck has three jaws, concentric and eccentric, capable of receiving a 44-inch wheel and quickly movable to any diameter. Boring spindle has six self-acting feeds quickly changeable while running, rapid hand movement by rack and pinion, and a concentric adjustment for wear by a conical binder at both ends of bearing in frame. Power crane, with rapid movement, for placing and removing the wheels. Includes L. R. Faught's patent quadruple cutter, countershaft and wrenches. Automatic hub-facing attachment applied when required.

NOTE.—Since the illustration was made, we have changed the chuck in table to one of five jaws.



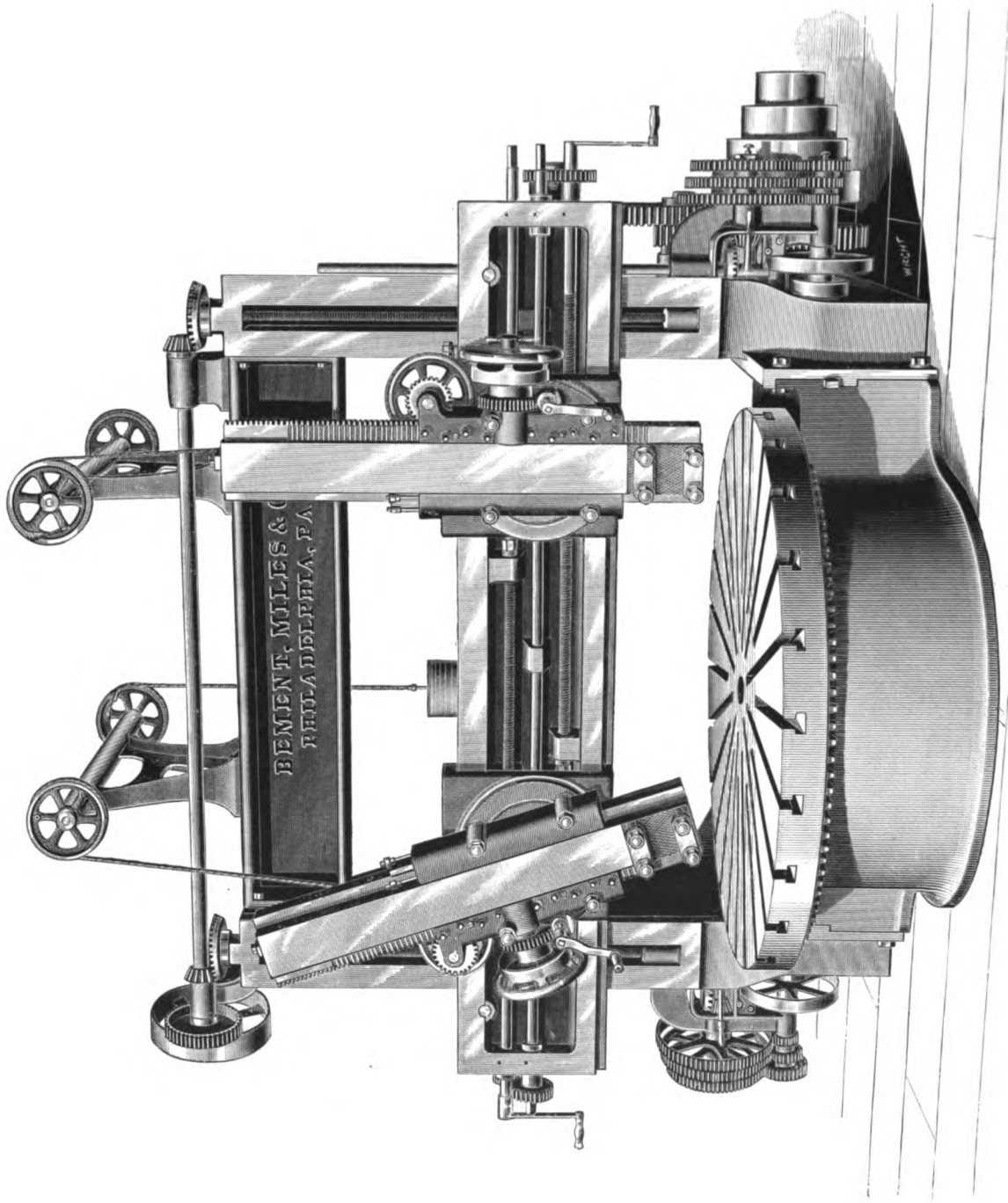
60-INCH VERTICAL BORING AND TURNING MACHINE.

48-INCH VERTICAL BORING AND TURNING MACHINE.

Can be built with one or two heads, as required. Swings $48\frac{1}{2}$ inches in diameter and $30\frac{1}{2}$ inches high. Table is 42 inches in diameter and has eight changes of speed by cone and gearing. Tool slides have 24 inches vertical and angular traverse, rapid hand movement, four changes of feed, and counterbalance supported on frame of machine. When the machine is constructed with two heads, each is furnished with a holder for turning tools and one of them with a cutter holder for boring. Countershaft and wrenches included.

60-INCH VERTICAL BORING AND TURNING MACHINE.

Can be built with one or two heads, as required. Swings 61 inches in diameter and 43 inches high. Table is 57 inches in diameter, supported upon a large spindle with a broad outer bearing. Power is applied by a cone and back gearing to a full sized spur gear on table, giving ten changes of speed. Cutter bars have 30 inches vertical or angular traverse, rapid hand motion, an infinite gradation of automatic reversible feeds from the finest to $\frac{3}{4}$ inch, variable while the machine is running, and a separate counterbalance for each head supported upon the machine. Cross head raised and lowered by power, the adjustment always being effected while the machine is otherwise at rest. When constructed with two heads, each has a complete feeding arrangement of its own, rendering one entirely independent of the other. Countershaft and wrenches included. A chuck in table will be provided, if required.



84-INCH VERTICAL BORING AND TURNING MACHINE.

72-INCH VERTICAL BORING AND TURNING MACHINE.

Can be built with one or two heads, as required. Swings 73 inches in diameter and 43 inches high. Table is 66 inches in diameter, supported upon a large spindle with broad outer bearing. Power is applied by a cone and back gearing to a full sized spur gear on the table, giving ten changes of speed. Cutter bars have 30 inches vertical or angular traverse, rapid hand motion, an infinite gradation of automatic reversible feeds from the finest to $\frac{3}{4}$ inch, variable while the machine is running, and a separate counterbalance for each head, supported upon the machine. Cross head raised and lowered by power, the adjustment always being effected while the machine is otherwise at rest. When constructed with two heads, each has a complete feeding arrangement of its own, rendering one entirely independent of the other. Countershaft and wrenches included. A slotting attachment will be added, if required.

84-INCH VERTICAL BORING AND TURNING MACHINE.

Can be built with one or two heads, as required. Swings 85 inches in diameter and 49 inches high. Table is 76 inches in diameter, supported upon a large spindle with a broad outer bearing. Power is applied by a cone and back gearing to a full sized spur gear on table, giving sixteen changes of speed. Cutter bars have 36 inches vertical or angular traverse, rapid hand motion, an infinite gradation of automatic reversible feeds from the finest to 1 inch, variable while the machine is running, and a separate counterbalance for each head, supported upon the machine. Cross head raised and lowered by power, the adjustment always being effected while the machine is otherwise at rest. When constructed with two heads, each has a complete feeding arrangement of its own, rendering one entirely independent of the other. Countershaft and wrenches included. A slotting attachment will be added, if required.

96-INCH VERTICAL BORING AND TURNING MACHINE.

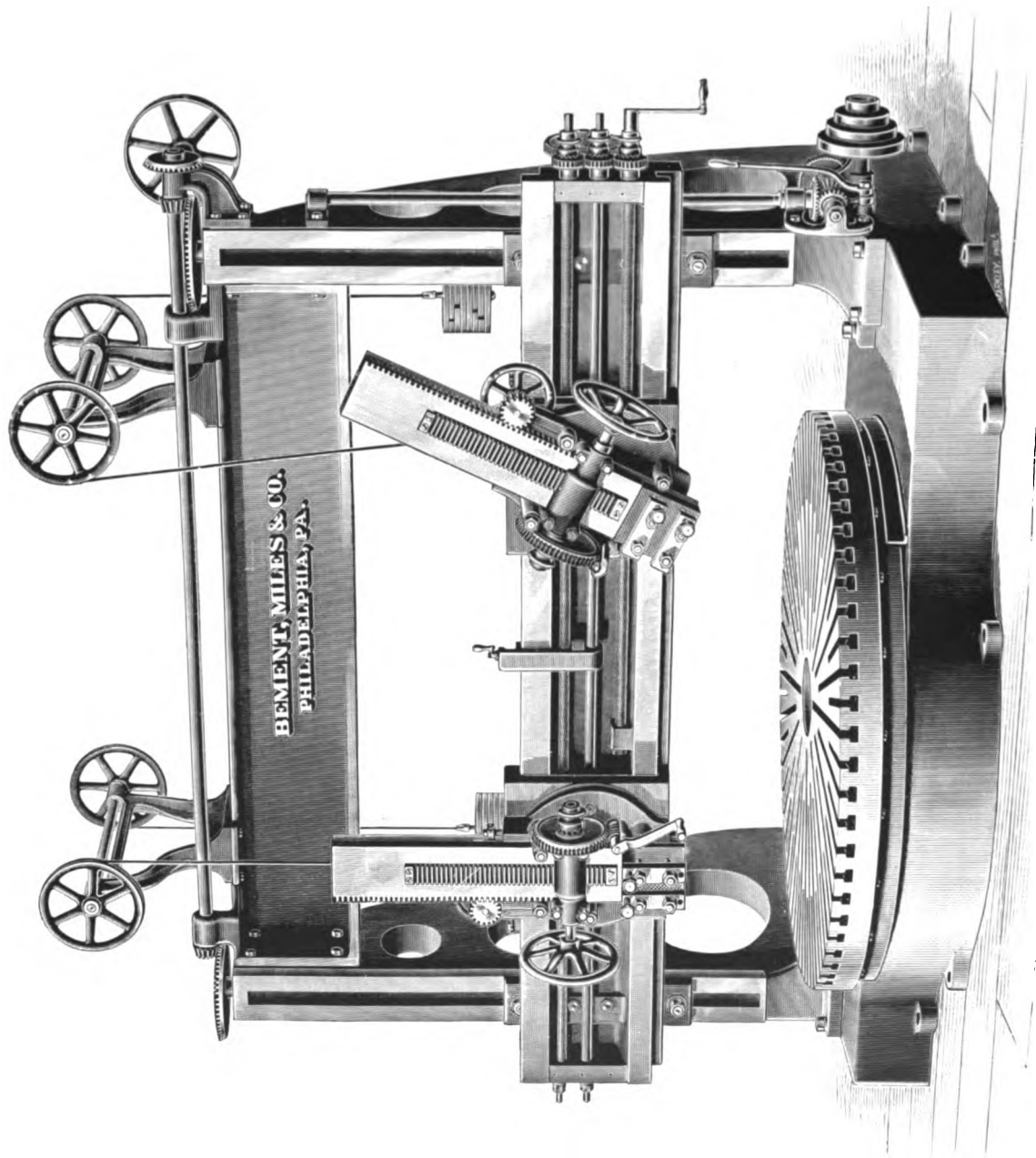
Can be built with one or two heads, as required. Swings 97 inches in diameter and 55 inches high. Table is 80 inches in diameter, supported upon a large spindle with a broad annular bearing near outer edge of table. Power is applied by a cone and back gearing to a full sized spur gear on table, giving sixteen changes of speed. Cutter bars have 48 inches vertical or angular traverse, rapid hand movement, an infinite gradation of automatic reversible feeds from the finest to 1 inch, variable while the machine is running, and a separate counterbalance for each head, supported upon the machine. Cross slide raised and lowered by power, the adjustment being always effected while the machine is otherwise at rest. When constructed with two heads, each has a complete feeding arrangement of its own, rendering one entirely independent of the other. Countershaft and wrenches included.



120-INCH VERTICAL BORING AND TURNING MACHINE.

Can be built with one or two heads, as required. Swings 122 inches in diameter and 61 inches high. Table is 87 inches in diameter, supported upon a large spindle with a broad annular bearing near outer edge of table. Power is applied by a cone and back gearing to a full sized spur gear on table, giving twenty changes of speed. Cutter bars have 48 inches vertical or angular traverse, rapid hand movement, an infinite gradation of automatic reversible feeds from the finest to 1 inch, variable while the machine is running, and a separate counterbalance for each head, supported upon the machine. Cross slide raised and lowered by power, the adjustment being always effected while the machine is otherwise at rest. When constructed with two heads, each has a complete feeding arrangement of its own, rendering one entirely independent of the other. Countershaft and wrenches included.

The 120-inch machine is sometimes built with movable uprights to increase the swing to 14 feet.

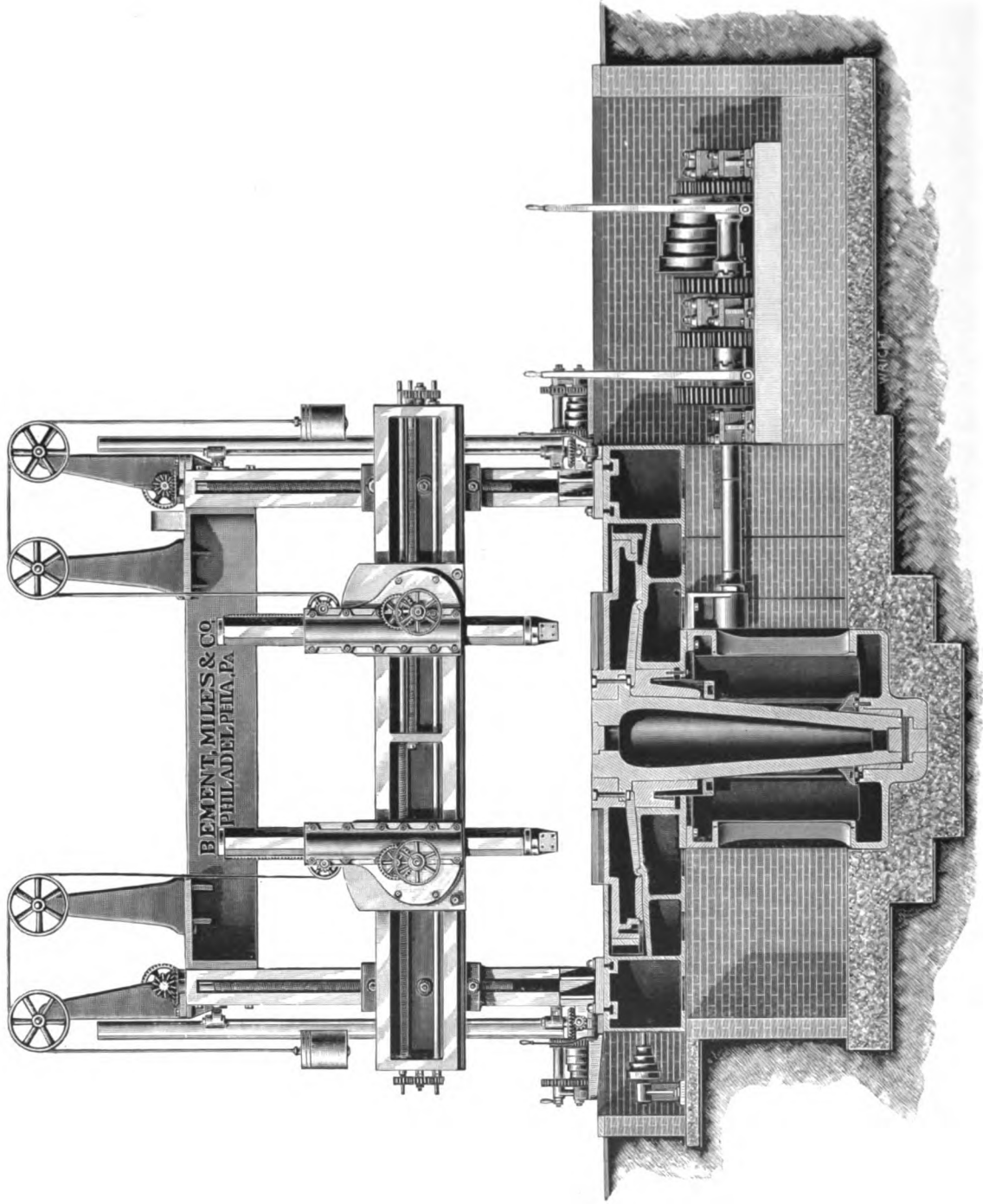


12-FOOT VERTICAL BORING AND TURNING MACHINE.

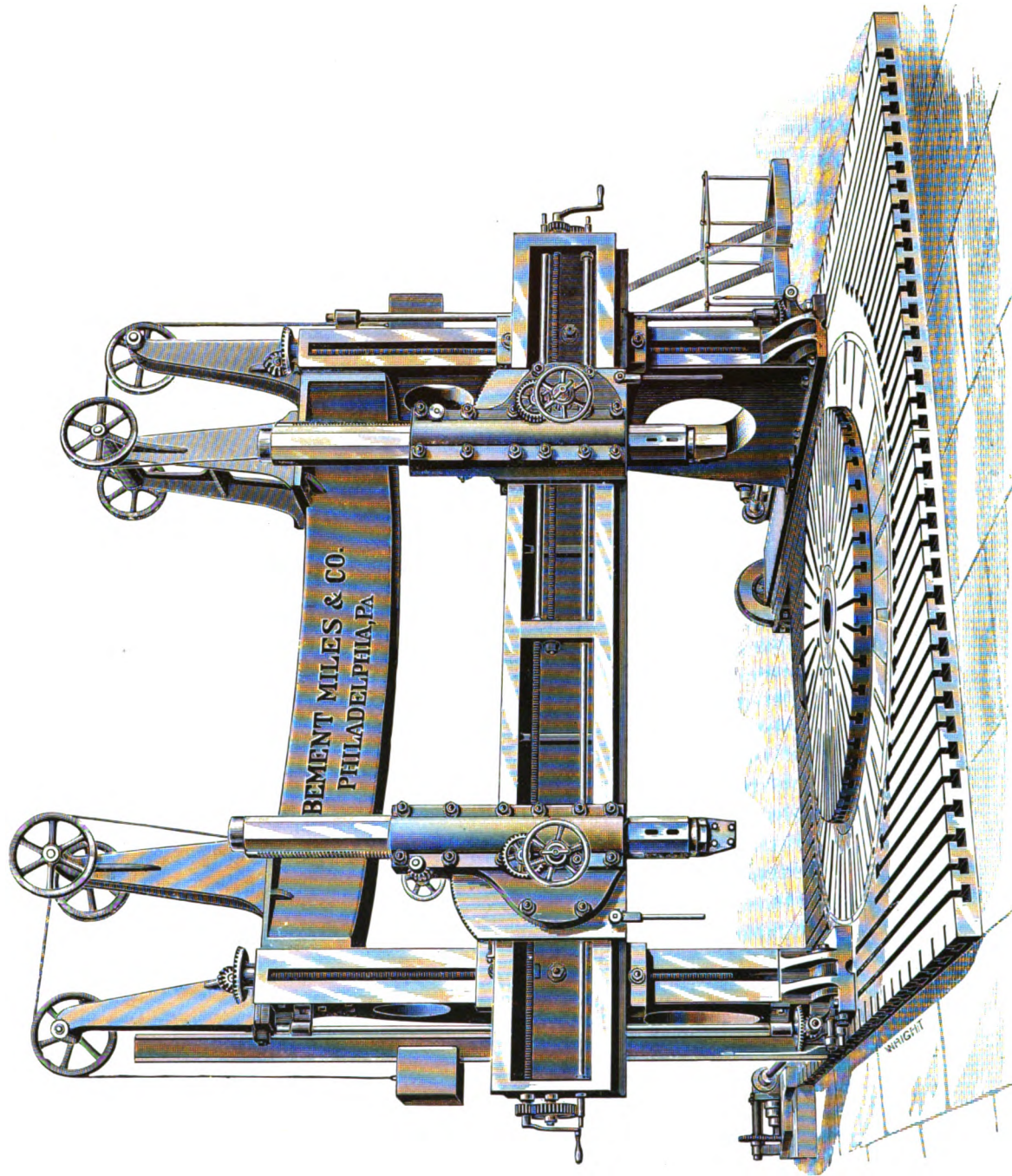
12-FOOT VERTICAL BORING AND TURNING MACHINE.

Can be built with one or two heads, as required. Swings 146 inches in diameter and 74 inches high. Table is 9 feet in diameter, supported upon a large spindle with a broad annular bearing and adjustment for wear. Power is applied by a cone and back gearing to a full sized spur gear on table, giving twenty changes of speed. Cutter bars have 48 inches vertical or angular traverse, rapid hand movement, an infinite gradation of automatic reversible feeds from the finest to $1\frac{1}{4}$ inches, variable while the machine is running, and a separate counterbalance for each head, supported upon the machine. Cross slide raised and lowered by power, the adjustment being always effected while the machine is otherwise at rest. When constructed with two heads, each has a complete feeding arrangement of its own, rendering one entirely independent of the other. Countershaft and wrenches included.

The above can be built with movable uprights to increase the swing to 17 feet.



16 TO 24-FOOT VERTICAL BORING AND TURNING MACHINE—SECTION.



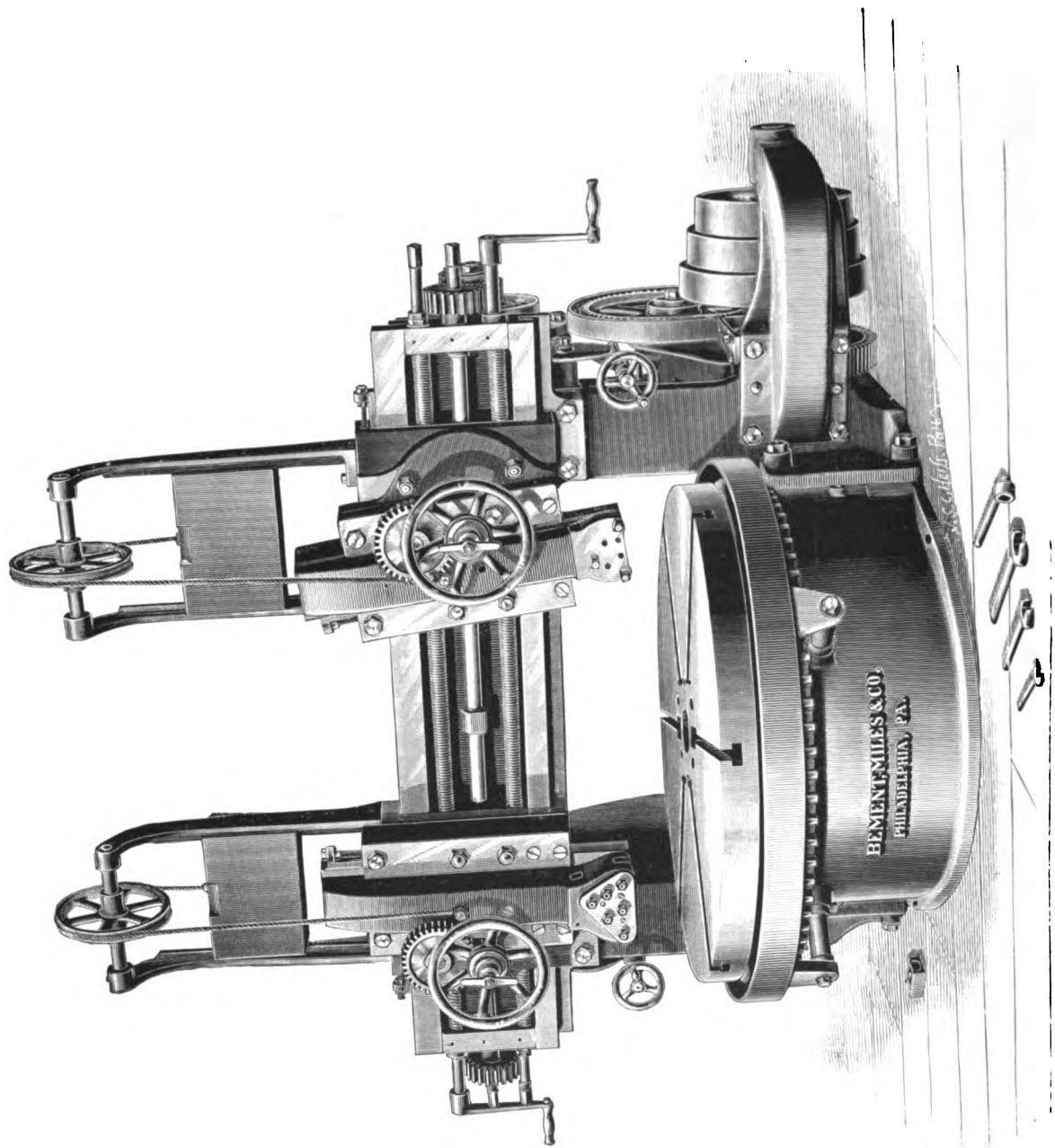
16 TO 24-FOOT VERTICAL BORING AND TURNING MACHINE.

14 TO 20-FOOT VERTICAL BORING AND TURNING MACHINE.

Usually constructed with two heads, each having a complete feeding arrangement of its own, rendering one entirely independent of the other. Swings 14 feet 2 inches in diameter by 8 feet 2 inches in height. By moving the uprights backward, which is done by power through connected screws, the swing may be increased to 20 feet 3 inches. Table is 12 feet in diameter, supported upon a large spindle with a broad annular bearing near outer edge of table and adjustment for wear in all directions. Power is applied by cone and back gearing through intermediate gears to the large spur face plate on table, giving twenty-four different speeds. Cutter bars have a vertical or angular traverse of 60 inches, rapid hand movement, vertical as well as horizontal, arranged upon each saddle, an infinite gradation of automatic reversible feeds from the finest to $1\frac{1}{4}$ inches, variable while the machine is running, and a separate counterbalance for each head, supported upon the machine. Cross slide raised and lowered by power, the adjustment being always effected while the machine is otherwise at rest. Countershaft and wrenches included.

16 TO 25-FOOT VERTICAL BORING AND TURNING MACHINE.

Usually constructed with two heads, each having a complete feeding arrangement of its own, rendering one entirely independent of the other. Swings 16 feet 2 inches in diameter by 10 feet 2 inches in height. By moving the uprights backward, which is done by power through connected screws, the swing may be increased to 25 feet 6 inches. Table is 12 feet in diameter, supported upon a large spindle with a broad annular bearing near outer edge of table and adjustment for wear in all directions. Power is applied by cone and back gearing through intermediate gears to the large spur face plate on table, giving twenty-four different speeds. Cutter bars have a vertical or angular traverse of 72 inches, rapid hand movement, vertical as well as horizontal, arranged upon each saddle, an infinite gradation of automatic reversible feeds from the finest to $1\frac{1}{2}$ inches, variable while the machine is running, and a separate counterbalance for each head, supported upon the machine. Cross slide raised and lowered by power, the adjustment being always effected while the machine is otherwise at rest. Countershaft and wrenches included.



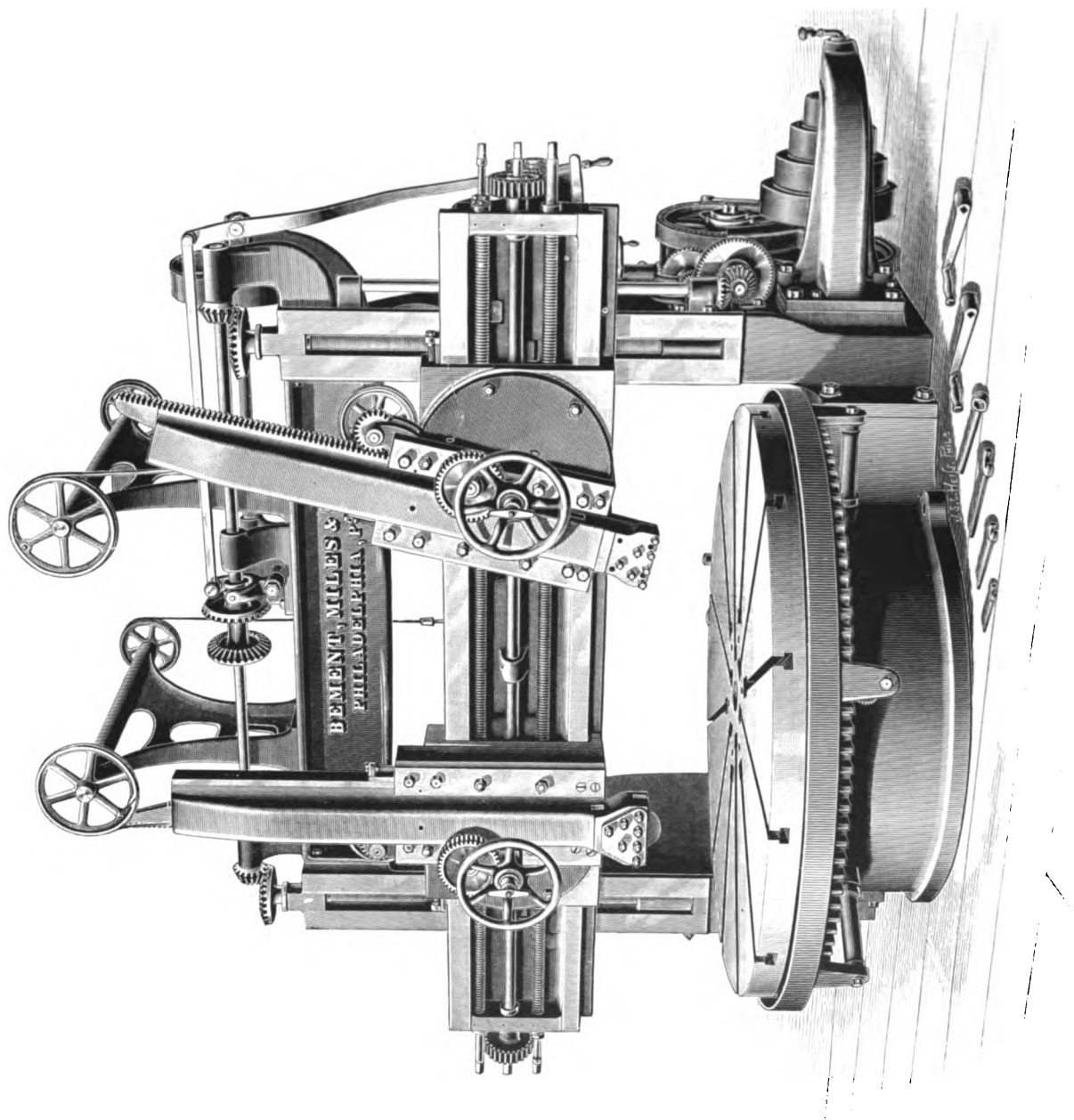
66-INCH TIRE BORING AND TURNING MACHINE.

66-INCH TIRE BORING AND TURNING MACHINE.

Swings 66 inches in diameter. Constructed with two entirely independent heads upon a fixed cross slide, which is usually placed 14 inches above the table. Cutter bars have 16 inches vertical traverse, with the necessary angular adjustment, rapid hand movement, an infinite gradation of automatic reversible feed from the finest to $\frac{3}{4}$ inch, and a separate counterbalance for each head. Table is 60 inches in diameter, supported upon a large spindle with a broad annular bearing near edge of table, having also a pan for receiving the lubricant. Power is applied by cone and back gearing to a full sized spur gear on table, giving twelve changes of speed. When desired, the machine can be constructed with high uprights and the cross slide arranged to raise and lower through 42 inches. The tool holding device may be altered to suit different requirements. Countershaft and wrenches included.

78-INCH TIRE BORING AND TURNING MACHINE.

Swings 78 inches in diameter. Constructed with two entirely independent heads upon a fixed cross slide, which is usually placed 15 inches above the table. Cutter bars have 16 inches vertical traverse, with the necessary angular adjustment, rapid hand movement, an infinite gradation of automatic reversible feed from the finest to $\frac{3}{4}$ inch and a separate counterbalance for each head. Table is 72 inches in diameter, supported upon a large spindle with a broad annular bearing near edge of table having also a pan for receiving the lubricant. Power is applied by cone and back gearing to a full sized spur gear on table, giving twelve changes of speed. When desired, the machine can be constructed with high uprights and the cross slide arranged to raise and lower through 43 inches. The tool holding device may be altered to suit different requirements. Countershaft and wrenches included.



102-INCH TIRE BORING AND TURNING MACHINE.

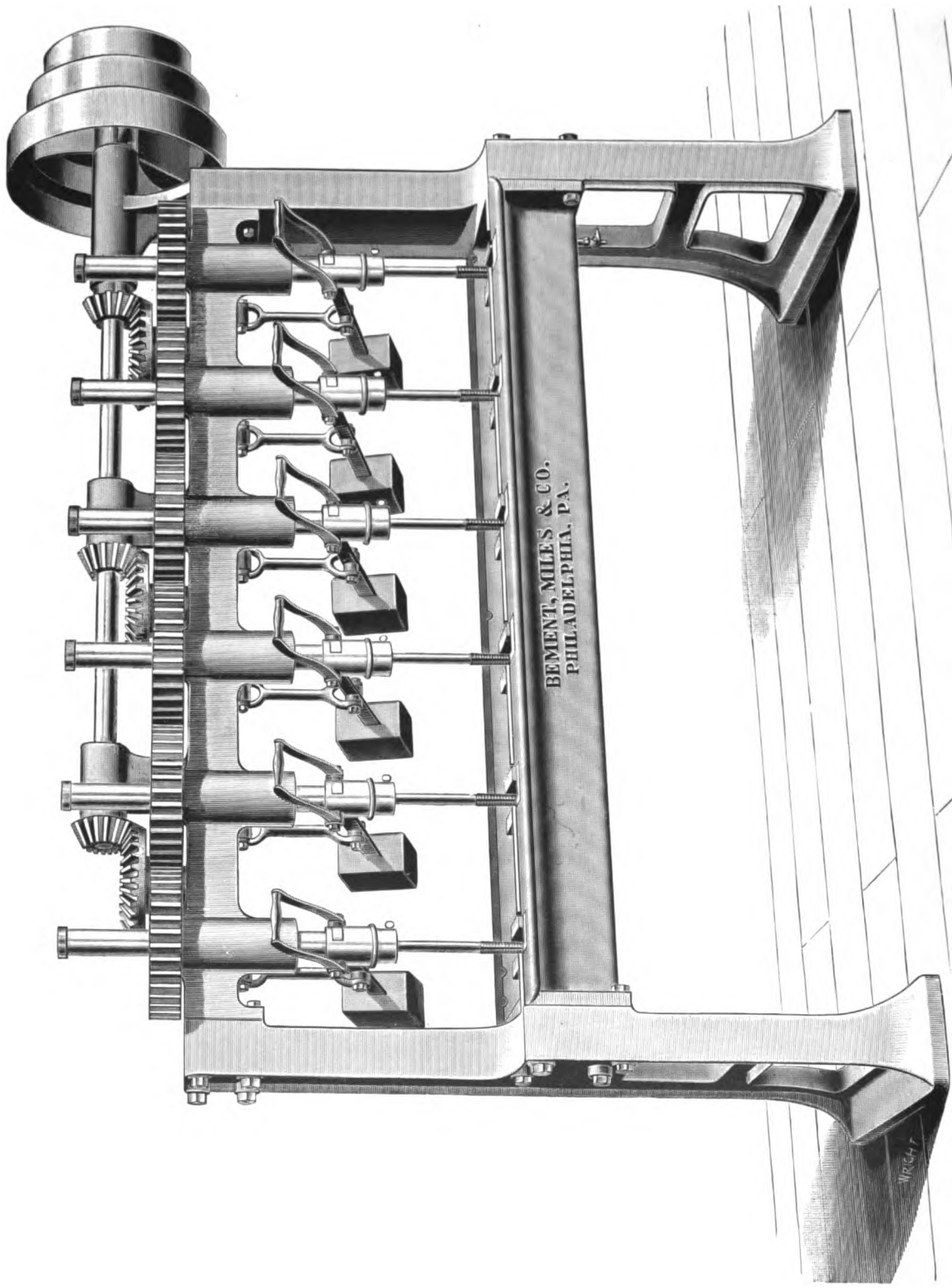
90-INCH TIRE BORING AND TURNING MACHINE.

Swings 90 inches in diameter. Constructed with two entirely independent heads upon a fixed cross slide, which is usually placed 16 inches above the table. Cutter bars have 20 inches vertical traverse, with the necessary angular adjustment, rapid hand movement, an infinite gradation of automatic reversible feed from the finest to 1 inch, and a separate counterbalance for each head. Table is 84 inches in diameter, supported upon a large spindle with a broad annular bearing near edge of table, having also a pan for receiving the lubricant. Power is applied by cone and back gearing to a full sized spur gear on table, giving sixteen changes of speed. When desired, the machine can be constructed with high uprights and the cross slide arranged to raise and lower through 54 inches. The tool holding device may be altered to suit different requirements. Countershaft and wrenches included.

102-INCH TIRE BORING AND TURNING MACHINE.

Swings 102 inches in diameter. Constructed with two entirely independent heads upon a fixed cross slide, which is usually placed 16 inches above the table. Cutter bars have 20 inches vertical traverse, with the necessary angular adjustment, rapid hand movement, an infinite gradation of automatic reversible feed from the finest to 1 inch, and a separate counterbalance for each head. Table is 96 inches in diameter, supported upon a large spindle with a broad annular bearing near edge of table, having also a pan for receiving the lubricant. Power is applied by cone and back gearing to a full sized spur gear on table, giving sixteen changes of speed. When desired, the machine can be constructed with high uprights and the cross slide arranged to raise and lower through 54 inches. The tool holding device may be altered to suit different requirements. Countershaft and wrenches included.

Nut Tapping, Plate Bending,
Punching
and Shearing Machines.



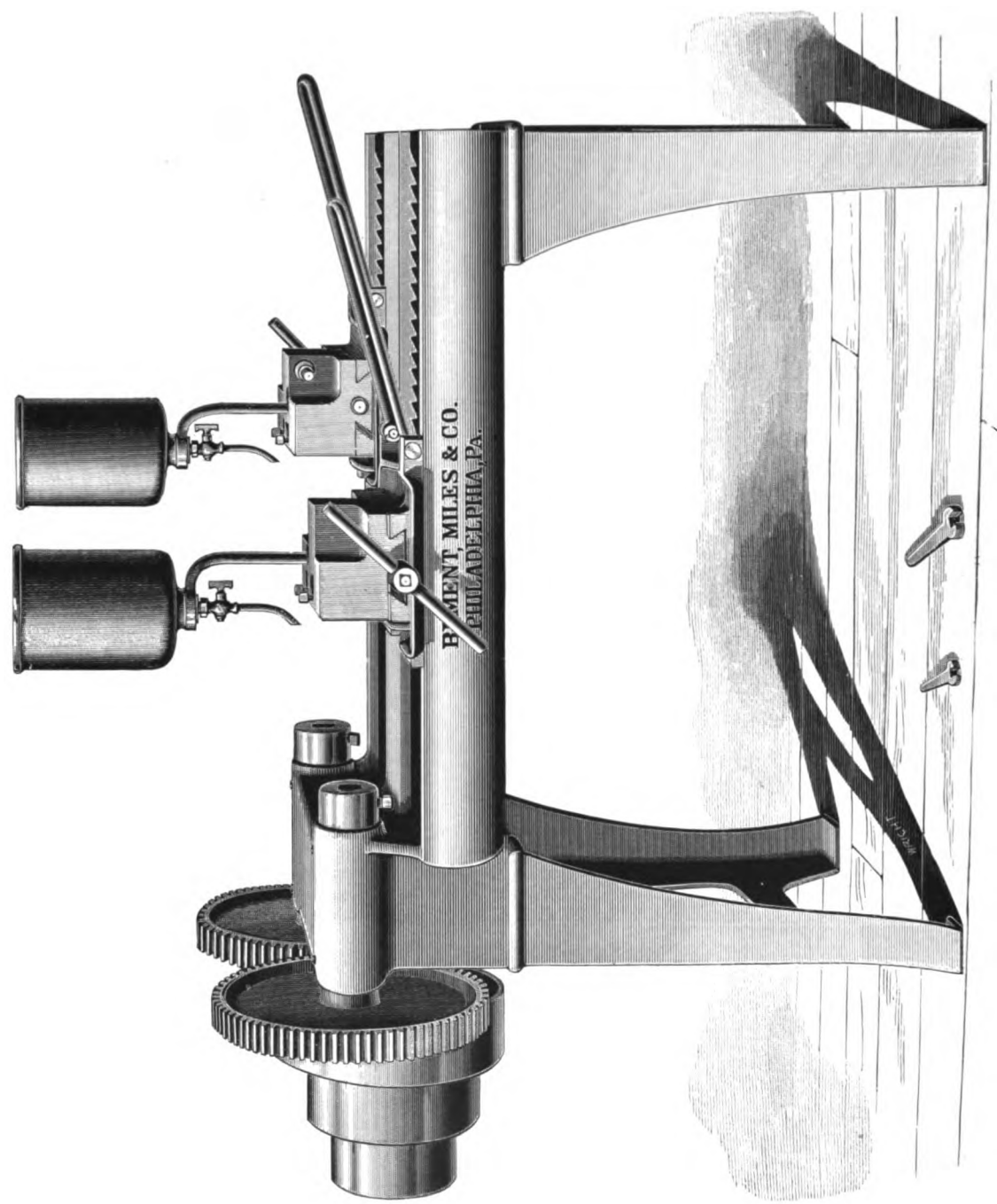
SIX-SPINDLE NUT TAPPING MACHINE.

THREE-SPINDLE BOLT CUTTING MACHINE.

Will cut three 1-inch bolts at once. Driven by cone with three changes, and gearing. Dies revolve and open automatically or by hand, allowing the bolts to be withdrawn without loss of time and without reversing or stopping machine; they are of the simplest possible form, and can be very easily adjusted, and cheaply repaired or replaced. Automatic pump forces the oil into a reservoir, from which it is fed to each spindle as required. Slides arranged for holding long or short bolts, or both, and provided with lever for entering bolts into the dies. Countershaft and wrenches included.

SIX-SPINDLE NUT TAPPING MACHINE.

Will tap five 1-inch and one 1½-inch nuts at once. Driven by cone with three changes, and gearing. Spindles have adjustable counterweights, and taps can be inserted in, and removed from, spindles while the latter are in motion. Nuts slide to their position in guides and are immersed in oil while being tapped. Countershaft included.



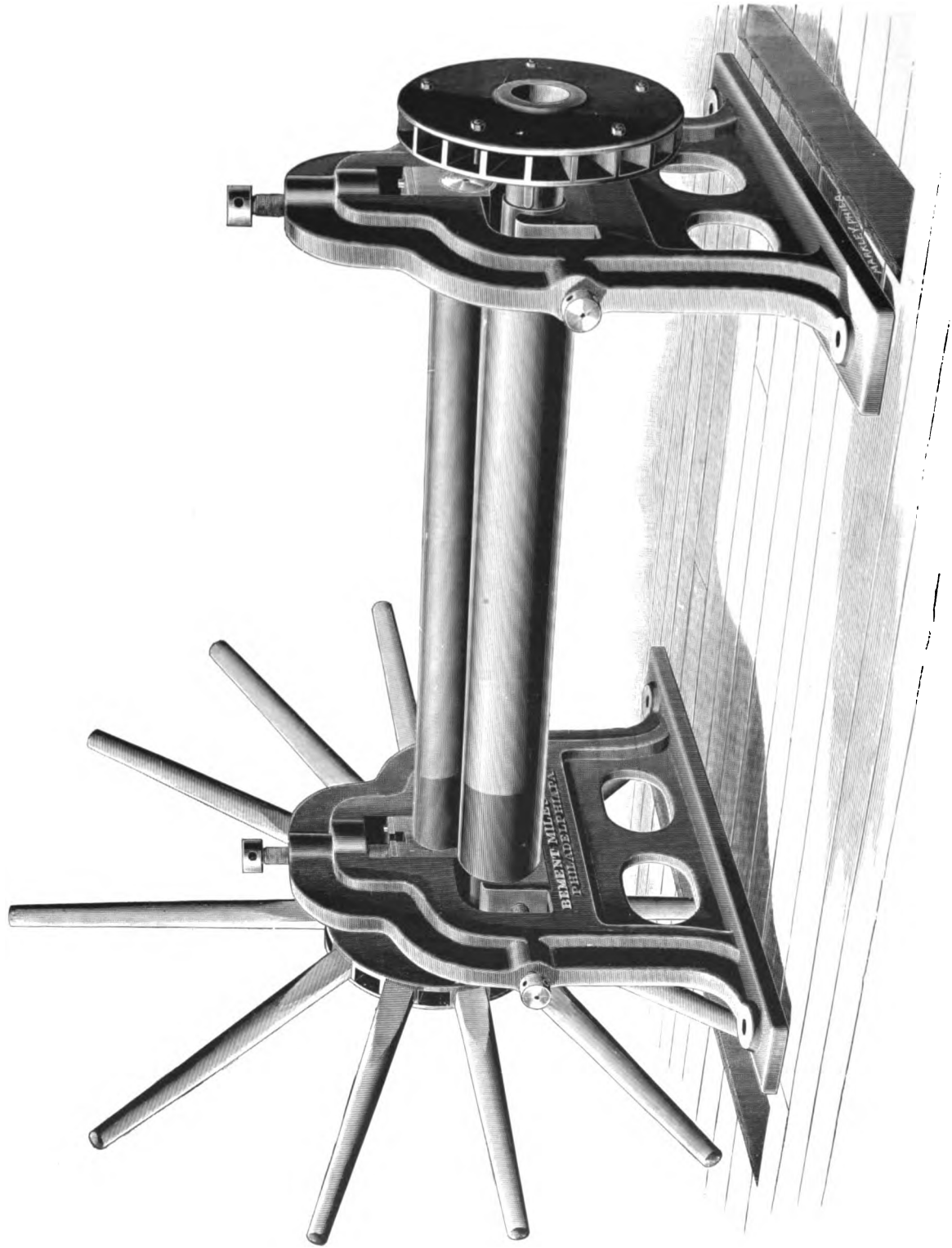
STAY-BOLT CUTTING AND NUT TAPPING MACHINE.

NUT AND WASHER FINISHING MACHINE.

Driven by 3-inch belt on cone pulley with four changes. Spindle is of cast steel, with conical bearing and adjustment for wear. Tool slide has movements at right angles, stop screws and two tool holders, for facing and chamfering. Tool closet in frame. Countershaft, wrenches and sample mandrel included.

STAY-BOLT CUTTING AND NUT TAPPING MACHINE.

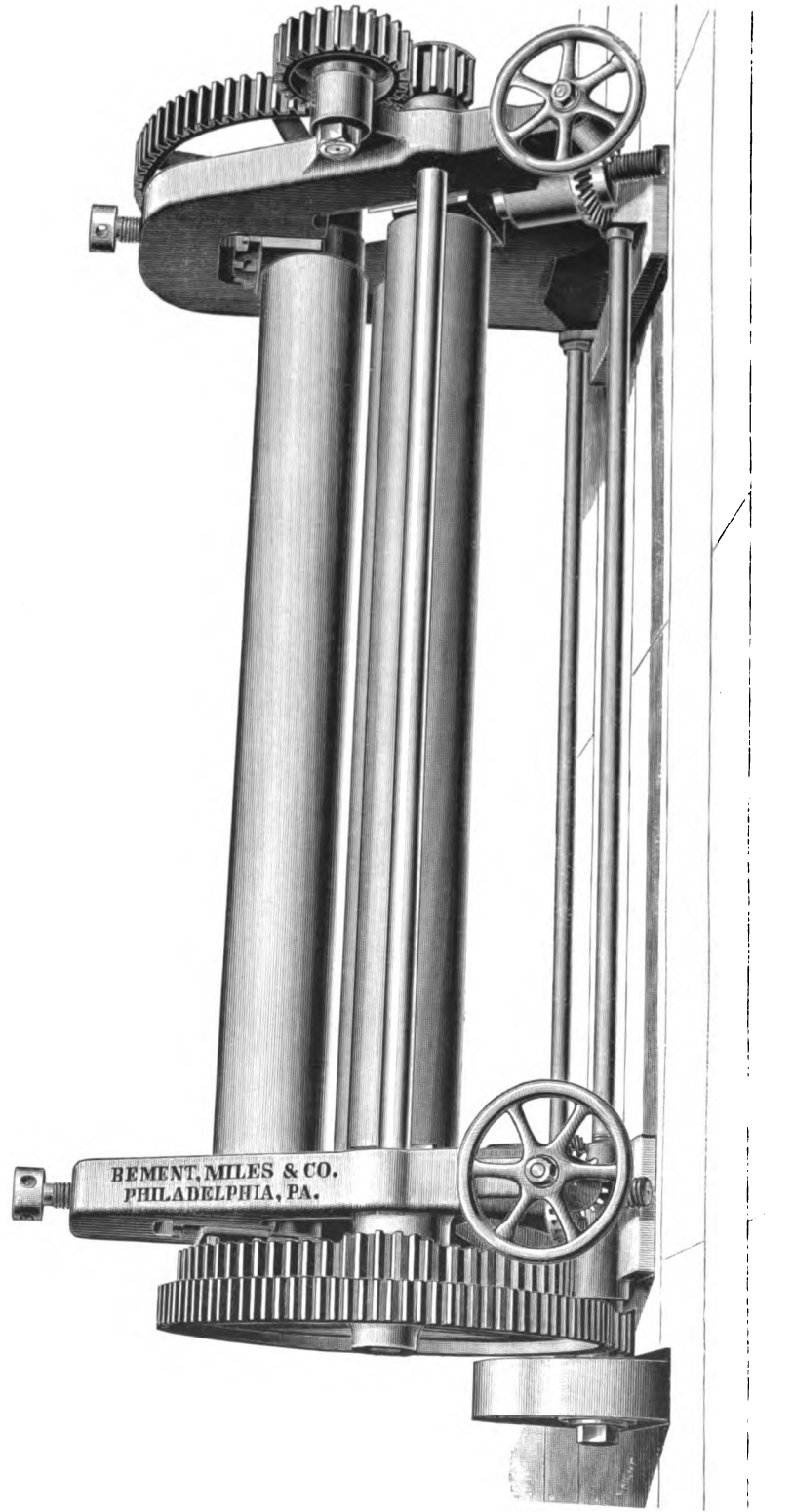
Driven by a large cone for a 4-inch belt, with three changes of speed, and strongly geared to two steel spindles, which have proper sockets to hold either stay bolts or taps, as required. The carriages, traversing freely upon the bed, are fitted with self-centring vises for holding either dies or nuts. A convenient lever, applied behind each carriage, starts the cuts. The bed forms a reservoir to hold oil used in cutting. Countershaft and wrenches included.



HAND PLATE BENDING MACHINE.

HAND PLATE BENDING MACHINE.

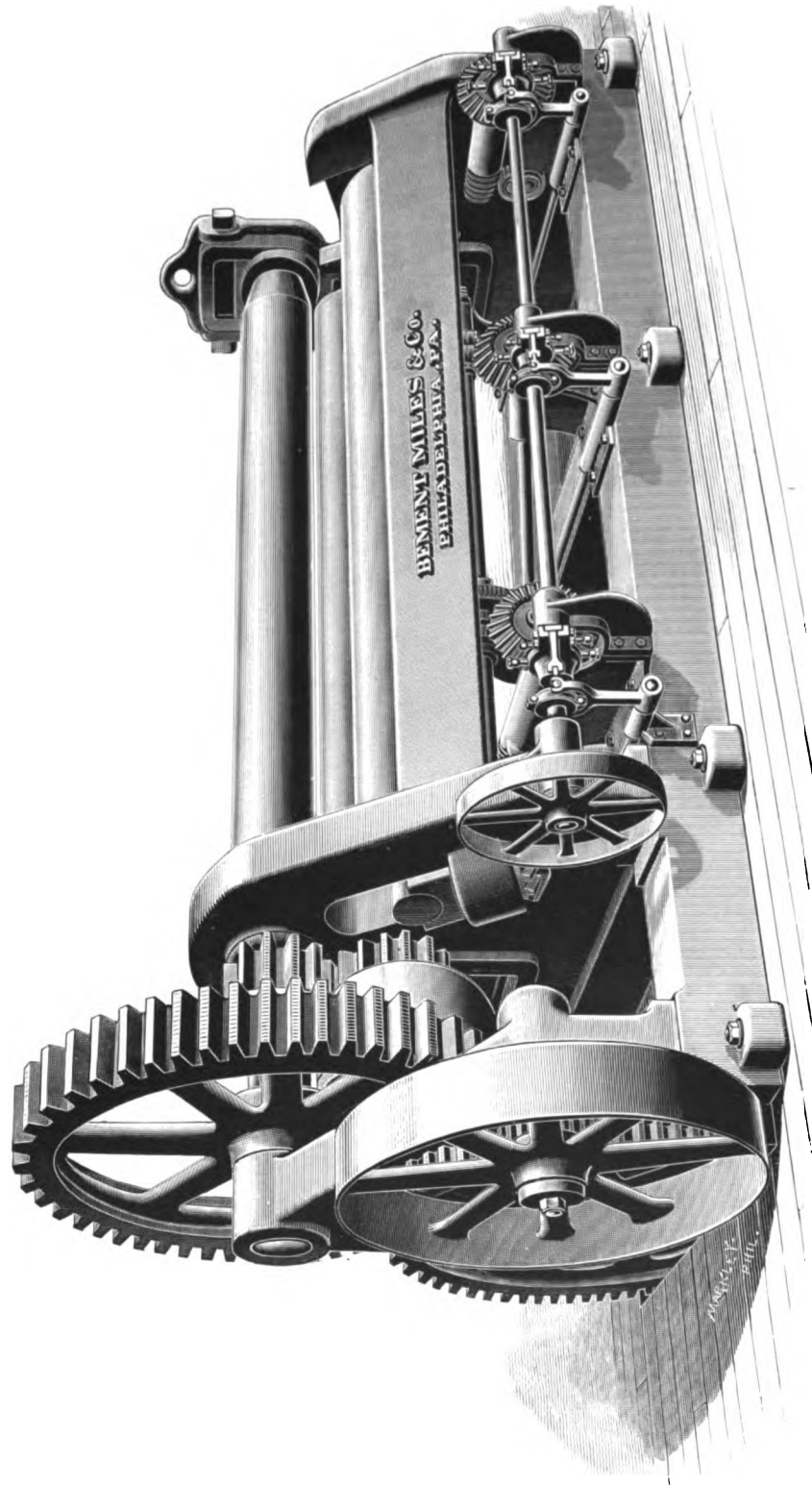
Will bend a $\frac{7}{16}$ -inch plate, 6 feet long. Has two lower rolls of wrought iron or steel 7 inches in diameter, with screws for horizontal adjustment, and an upper one of steel, $6\frac{1}{4}$ inches in diameter, with a like vertical adjustment, the latter arranged to be withdrawn lengthwise through its bearings when a rolled circle, or flue, is to be removed. Can be made longer, or shorter, than 6 feet.



No. 2 POWER PLATE BENDING MACHINE.

No. 2 POWER PLATE BENDING MACHINE.

Will bend a $\frac{3}{8}$ -inch plate, 10 feet long. Has an upper and lower pinching roll of wrought iron, or steel, 10 inches in diameter, each geared and variable in length to 10 (or more) feet between housings, the upper one being vertically adjustable by screws, and arranged to withdraw lengthwise through the housing when a rolled ring is to be removed. The side, or bending roll, is $9\frac{1}{4}$ inches diameter, and is independently adjustable at each end by screws, etc. Countershaft, with pulleys for reversing the motion of rolls, included.



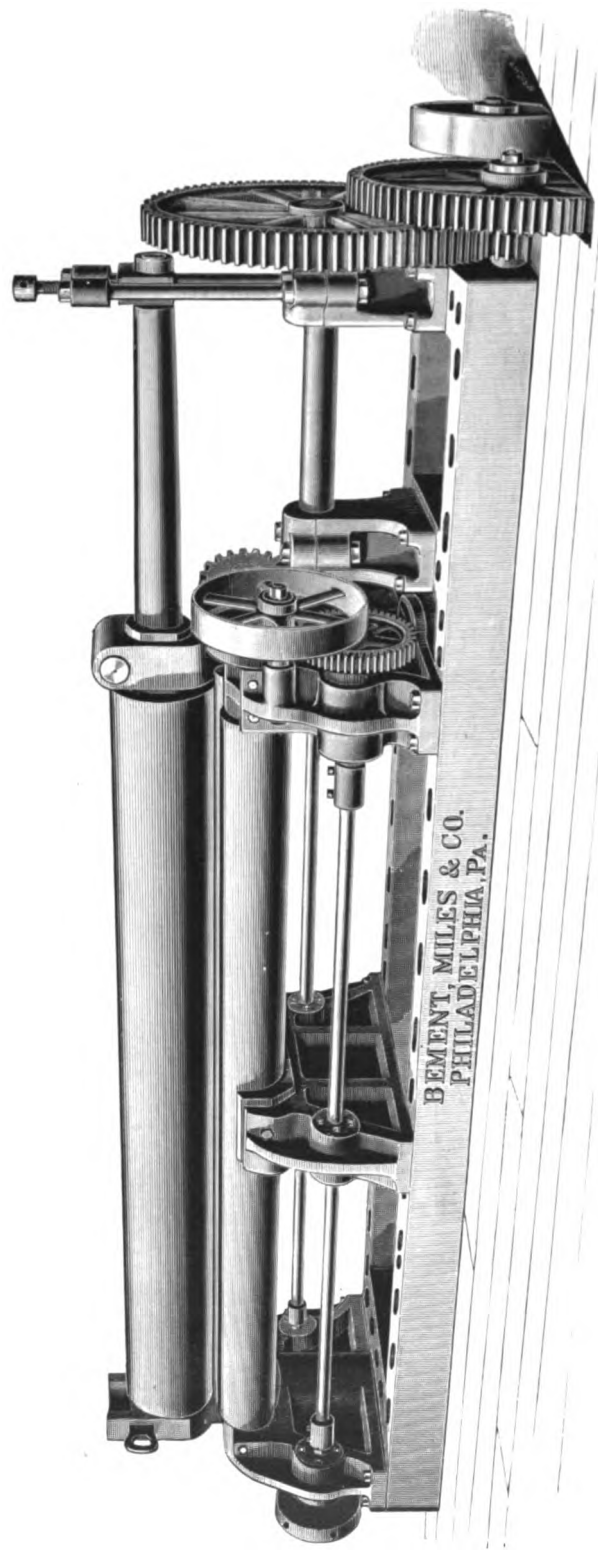
No. 4 POWER PLATE BENDING MACHINE.

No. 4 PLATE BENDING MACHINE.

Driven by belt with reversing countershaft, or by reversing engines, as preferred ; and capable of bending a 1-inch plate, 14 feet long. Consists of an upper and lower roll, 18 inches in diameter, the lower one being adjustable, driven by steel pinions, one having a series of friction washers to prevent the slipping of either roll on the plate ; and a side bending roll 16 inches in diameter, both ends of which are adjustable together, or separately, by power. All the rolls are of wrought iron, or steel. The upper pinching roll has at one end a jointed steel bearing, which may readily be swung down to permit the removal of a complete ring. Estimates include engines, or countershaft, as required.

No. 5 PLATE BENDING MACHINE.

Capable of bending $\frac{3}{8}$ -inch plates of any length up to 12 feet. Both lower rolls are driven positively, by gearing, in either direction. All of the rolls are of wrought iron, or steel, the upper one being extended at one end to receive the pressure of a screw, which supports the roll when a circle or flue is to be removed at the other end, the jointed bearing being movable for that purpose. The two ends of the upper roll have a vertical adjustment, separately or together, by hand or power. Lower rolls are 10 inches in diameter, and have a central bearing when made upwards of 8 feet in length ; upper one is 12 to 13 inches in diameter, depending upon its length. Two countershafts included.



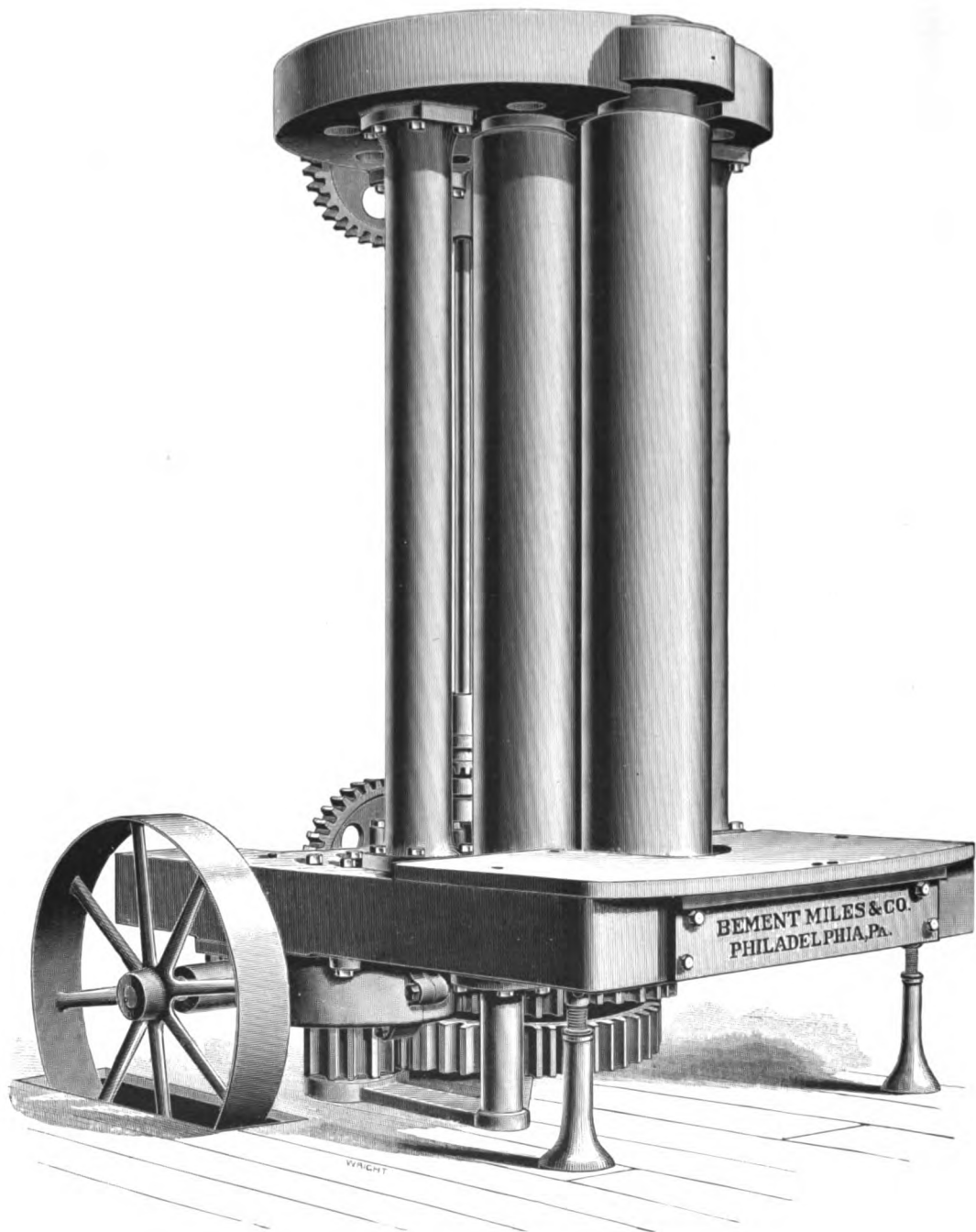
No. 7 POWER PLATE BENDING MACHINE.

No. 6 PLATE BENDING MACHINE.

Driven by belt with reversing countershaft, or by reversing engines, as preferred; and capable of bending a $1\frac{1}{4}$ -inch plate, 16 feet long. Consists of an upper and lower roll 20 inches in diameter, the lower one being adjustable, driven by steel pinions, one having a series of friction washers to prevent the slipping of either roll on the plate; and a side bending roll 18 inches in diameter, both ends of which are adjustable together or separately, by power. All the rolls are of wrought iron, or steel. The upper pinching roll has at one end a jointed steel bearing, which may readily be swung down to permit the removal of a complete ring. Estimates include engines, or countershaft, as required.

No. 7 PLATE BENDING MACHINE.

Capable of bending 1-inch iron of any length up to 12 feet. Both lower rolls are driven positively by gearing in either direction. The rolls are of wrought iron, or steel, the upper one being extended to receive the pressure of a screw bearing which supports the roll when a circle or flue is to be removed at the other end, the jointed bearing being movable for that purpose. The two ends of the upper roll have a vertical adjustment, separately or together, by hand or power. Lower rolls are 11 inches in diameter, and have a central bearing when made 8 feet or upwards in length; upper one 16 inches in diameter. Two countershafts included. If desired, the machine may be driven by a reversing engine.



No. 8 VERTICAL POWER PLATE BENDING MACHINE.

No. 8 VERTICAL PLATE BENDING MACHINE.

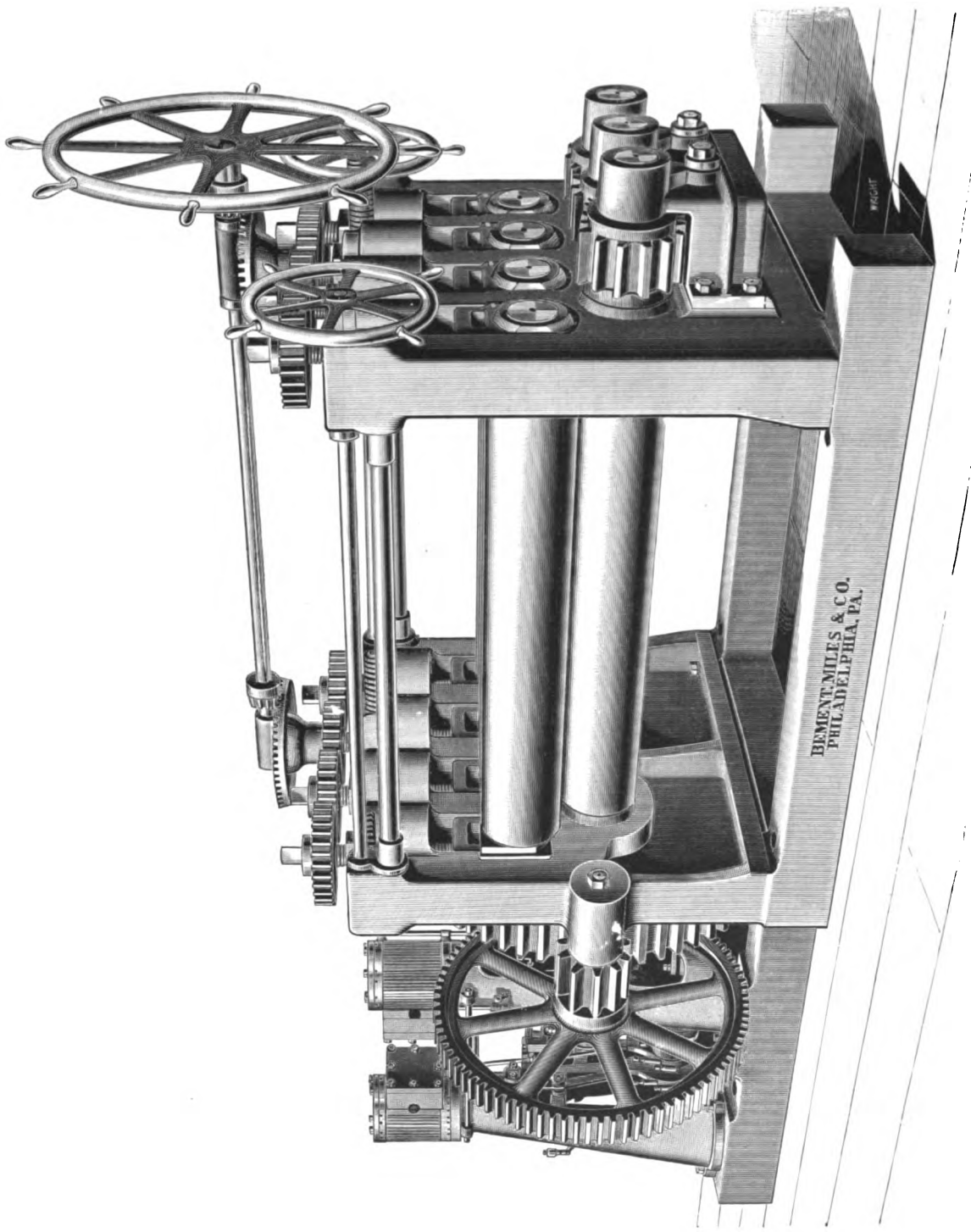
Capable of bending $1\frac{1}{4}$ -inch steel plates not exceeding 9 feet in width. All the rolls are of wrought iron, or steel; the two fixed rolls are driven positively in either direction. The two ends of the movable roll are adjustable separately, or together, by hand or power; it can also be counterbalanced and raised clear of the housing when a rolled ring is to be removed. Two countershafts, wrenches, etc., included. When desired, this machine can be driven by a pair of reversing engines.



No. 10 PLATE BENDING MACHINE, DRIVEN BY REVERSING ENGINES.

No. 10 PLATE BENDING MACHINE.

Operated by two pairs of reversing engines, one for driving the pinching rolls, and the other for raising and lowering the side, or bending, rolls; and capable of bending a $1\frac{1}{4}$ -inch plate, 16 feet long. The two pinching rolls are 21 inches in diameter, and the bending rolls 20 inches in diameter, all of steel, the lower one being adjustable; driven by steel pinions, one having a series of friction washers to prevent the slipping of either roll on the plate. Both ends of the side rolls are adjustable together, or separately. The upper pinching roll has at one end a jointed steel bearing, which may readily be swung down to permit the removal of a complete ring.



No. 2 PLATE STRAIGHTENING MACHINE.

No. 1 PLATE STRAIGHTENING MACHINE.

For $\frac{1}{2}$ -inch plates, 5 feet 6 inches wide. Consists of four upper and three lower rolls, of wrought iron, or steel, all 10 inches in diameter, which can be driven by belt, or reversing engine, as preferred. Upper rolls can be raised and lowered independently, or together. A graduated scale is provided, to adjust the rolls to different thicknesses of plate. When driven by belt, the reversing countershaft is included.

No. 2 PLATE STRAIGHTENING MACHINE.

For $\frac{3}{4}$ -inch plates, 6 feet wide. Consists of four upper and three lower rolls, of wrought iron, or steel, all 12 inches in diameter, which can be driven by belt, or reversing engine, as preferred. Upper rolls can be raised and lowered independently, or together. A graduated scale is provided, to adjust the rolls to different thicknesses of plate. When driven by belt, the reversing countershaft is included.

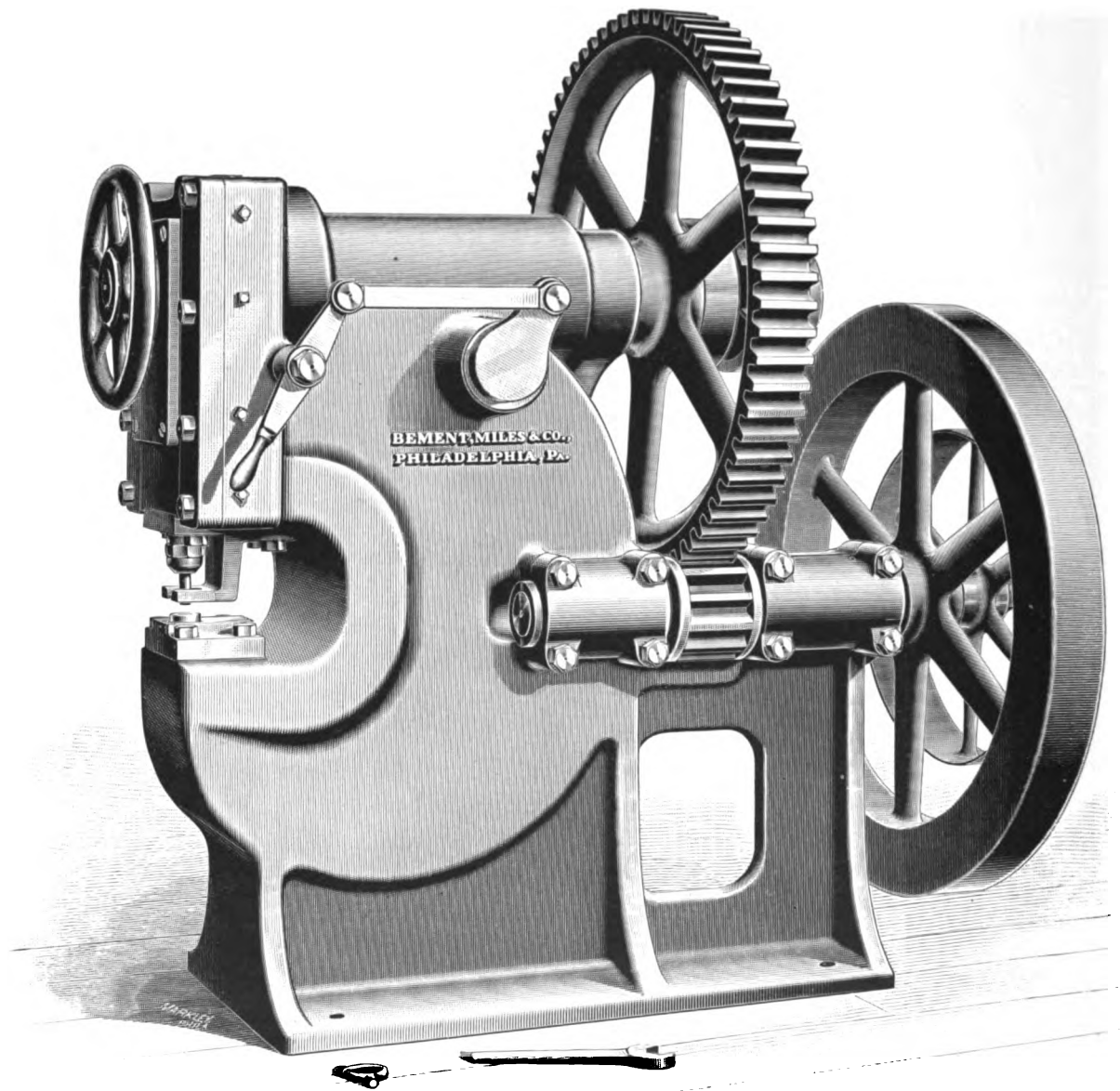
TABULATED LIST OF PUNCHING AND SHEARING MACHINES.

NUMBER OF MACHINE.	POWER TO PUNCH.	POWER TO SHEAR.	VARIOUS DEPTHS OF THROAT.						HOW CONSTRUCTED.
			8"	11"	15"	20"	25"		
No. 1	5/8" in 1/2"	3/8" Plate	8"	11"	15"	20"	25"	Single or combined, eccentric shaft movement.	
No. 2	3/4" in 3/4"	5/8" Plate	8"	12"	18"	24"	30"	Single or combined, eccentric shaft movement.	
No. 3	7/8" in 3/4"	5/8" Plate	24"	30"	36"	42"		Single lever movement.	
No. 4	1" in 3/4"	3/4" Plate	12"	16"	20"	24"	30"	Single or combined, eccentric shaft movement.	
No. 5	1" in 1"	7/8" Plate	12"	20"	26"	32"	40"	Single or combined, eccentric shaft movement.	
No. 6	1" in 1"	7/8" Plate	12"	18"	24"	30"	36"	Double, lever movement, special.	
No. 7	1 1/4" in 1"	1" Plate	24"	30"	36"	42"	48"	Single, lever movement.	
No. 8	1 1/4" in 1"	1" Plate	10"	20"	31"	36"	42"	48"	Single or combined, eccentric shaft movement.
No. 9	1 1/4" in 1 1/4"	1 1/8" Plate	12"	20"	30"	42"	48"	Single or combined, eccentric shaft movement.	
No. 10	1 1/2" in 1 1/4"	1 1/8" Plate	12"	18"	24"	30"	36"	48"	Single or combined, eccentric shaft movement.
No. 11	1 1/2" in 1 1/2"	1 1/4" Plate	14"	20"	28"	36"	42"	60"	
No. 12	2" in 1 1/2"	1 3/8" Plate	20"	25"	30"	36"	42"	Single or combined, eccentric shaft movement.	
No. 13	2" in 2"	1 1/2" Plate	24"	30"	36"				
No. 14	2 1/2" in 2"	1 5/8" Plate	24"	30"	36"	42"	48"	Single or combined, eccentric shaft movement.	
No. 15	3" in 2"	1 3/4" Plate	30"	36"	42"	48"		Single or combined, eccentric shaft movement.	

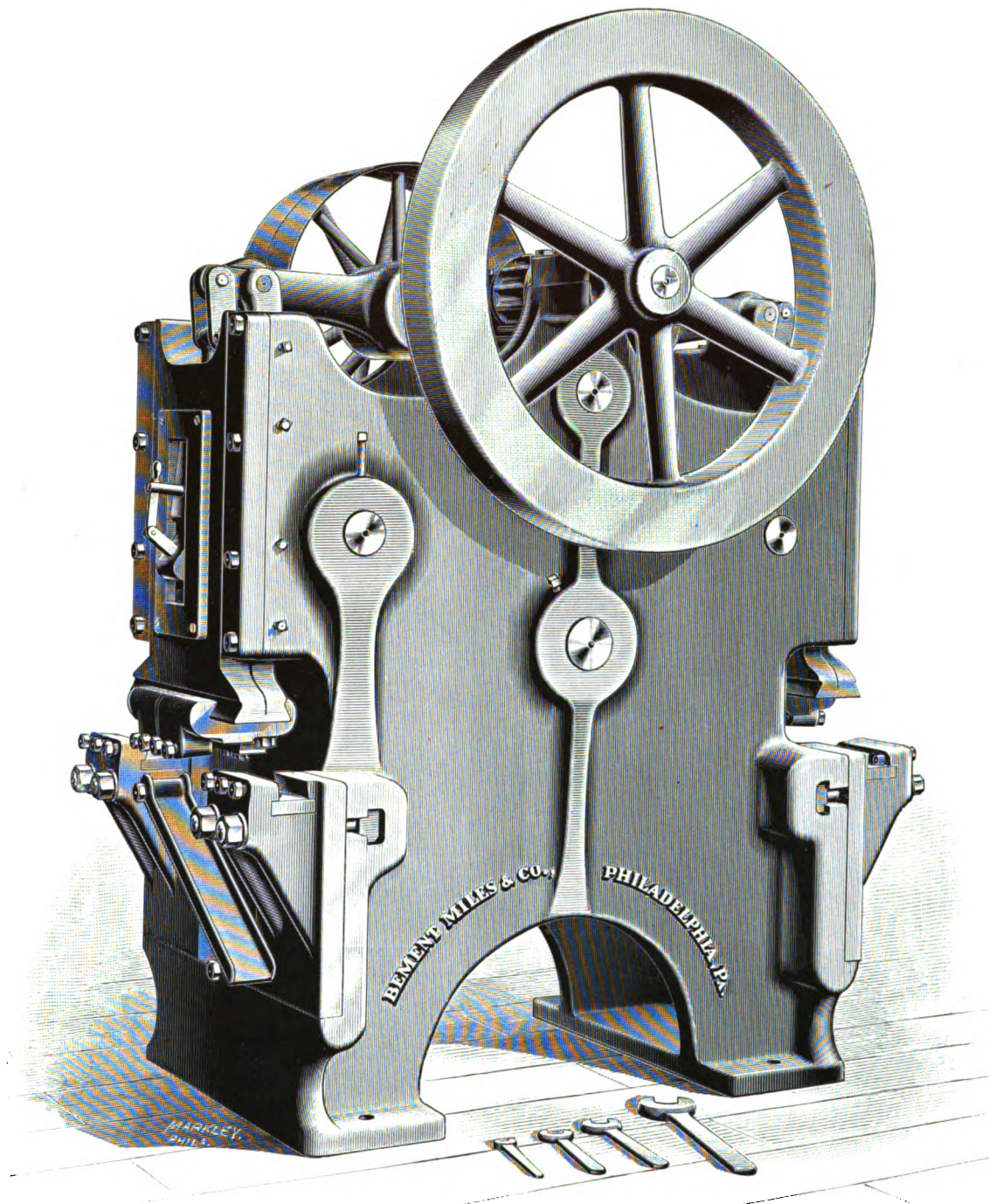
PUNCHING AND SHEARING MACHINES.

GENERAL REMARKS.

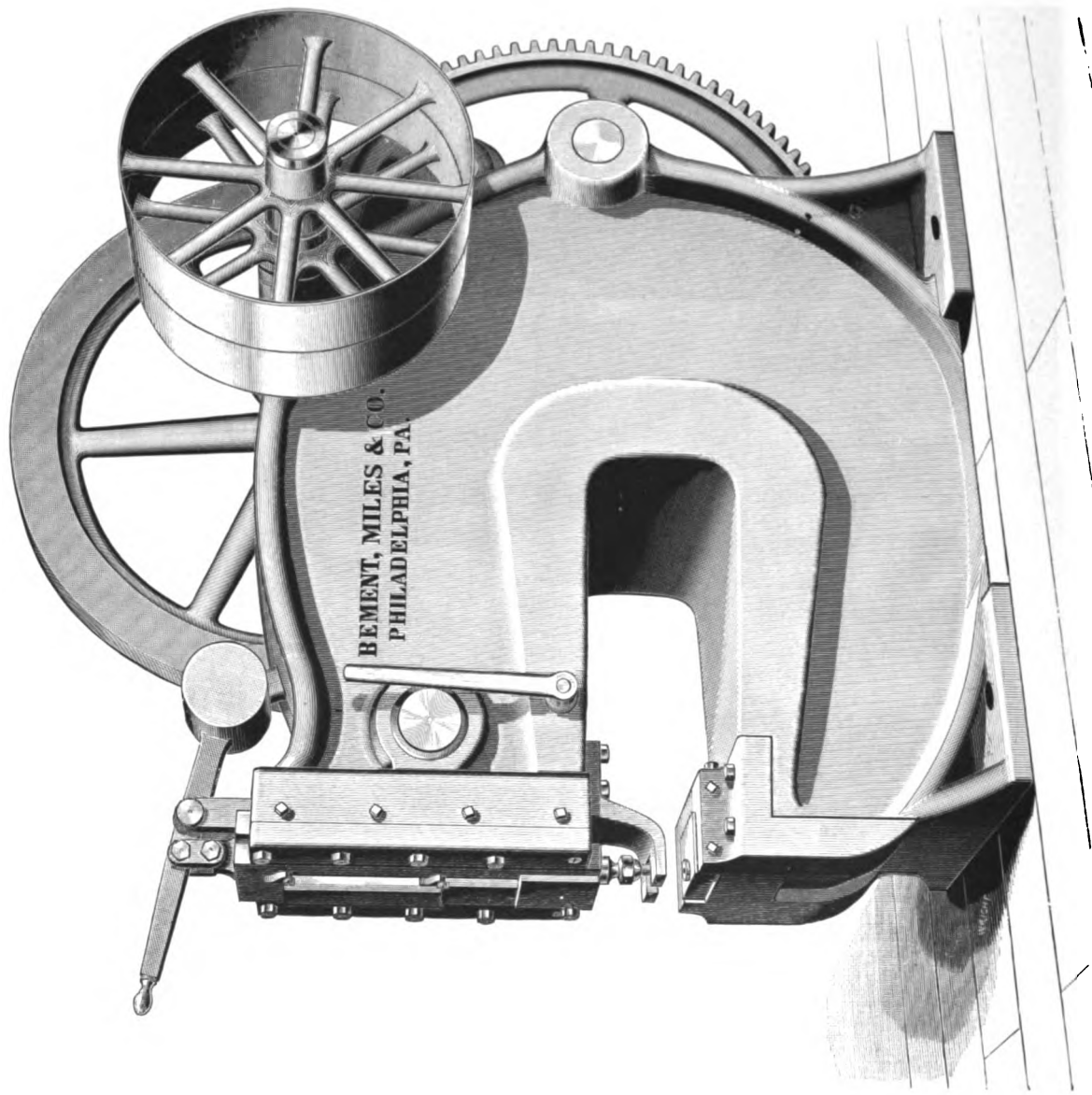
Upon examination of the tabulated list of punching and shearing machines, it will be seen that we build a great number of sizes, with varying depths of throat. Up to the present time we have not been called upon to make any machine larger than the No. 15, but we are prepared to do so when required. The machines constructed with eccentric shaft movement are operated through a vibrating pintle, the end of which, and the block upon which it rests are of hardened steel. A number are also built with lever movement, so as to cover all requirements. The stopping and starting of the heads of all the machines are effected by a hand lever, or treadle, or both, connected with a sliding block of hardened steel, the stopping always leaving the head at upper end of stroke. They can also be arranged to stop automatically at any desired point of the stroke. A clutch may be used instead of the sliding block arrangement. Special punches, dies and holders can be made to suit any kind of work, and the frame may be so constructed that holes can be punched close to its edge, or it may be so shaped as to permit the punching of I beams, channels, etc. Punching and shearing machines may be built for punching and plate shearing, punching and cross shearing, double shearing, or punching, plate shearing and cross shearing, one end of the machine, in the latter case, being arranged for two operations by having changeable upper and lower blocks. For punching accurately to lines, the counterbalanced plunger may be brought down by hand, permitting the punch to rest upon the work until the adjustment is made, the punching then being effected by throwing the head into gear by the lever. The punches, which are simple in form and conveniently changed, are firmly held in position by a threaded cap of wrought iron, which also affords a ready means of adjustment for wear of punches. Countershafts are not provided with our punching and shearing machines, unless specially ordered, as it is usually supposed that they will be driven directly from a main shaft to the tight and loose pulleys on the machines. In many cases the driving is effected by an engine attached to the frame. In addition to the sizes mentioned in the tabulated list, we build a number of special punching and shearing machines, a few of which are illustrated and briefly described. All of the vertical punches can be so constructed as to work horizontally, if desired.



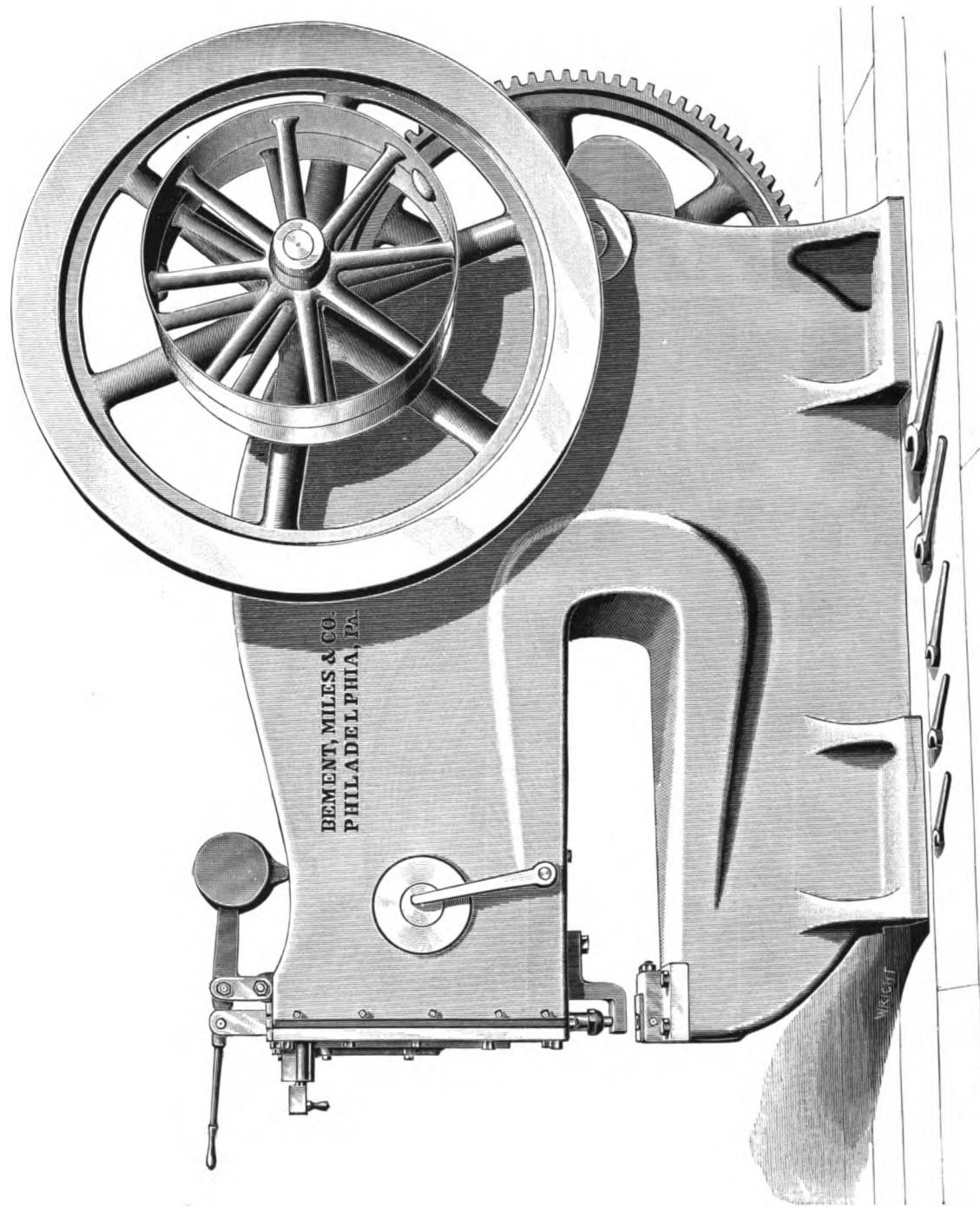
No. 2 PUNCHING MACHINE.



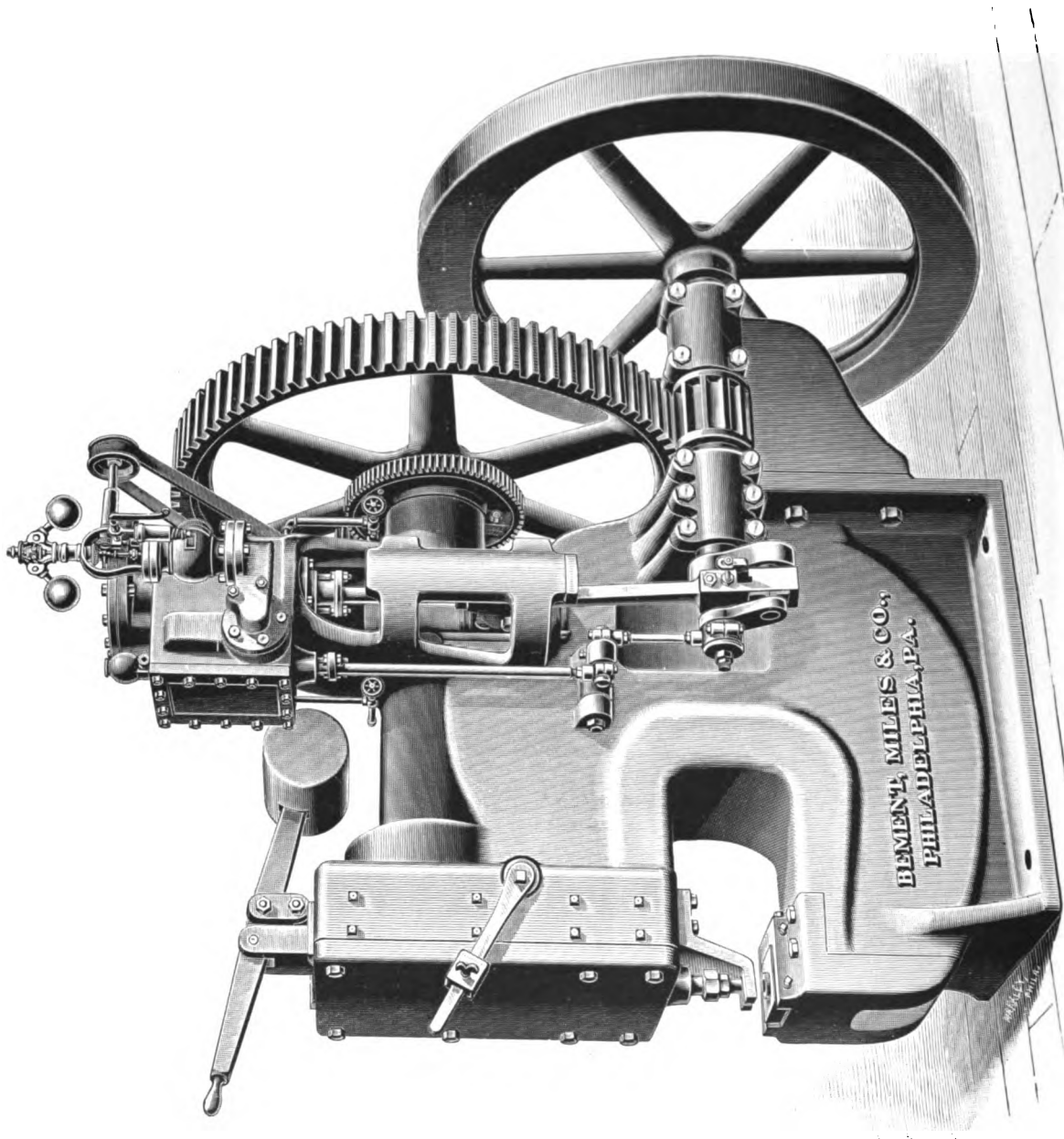
No. 6 PUNCHING AND SHEARING MACHINE.



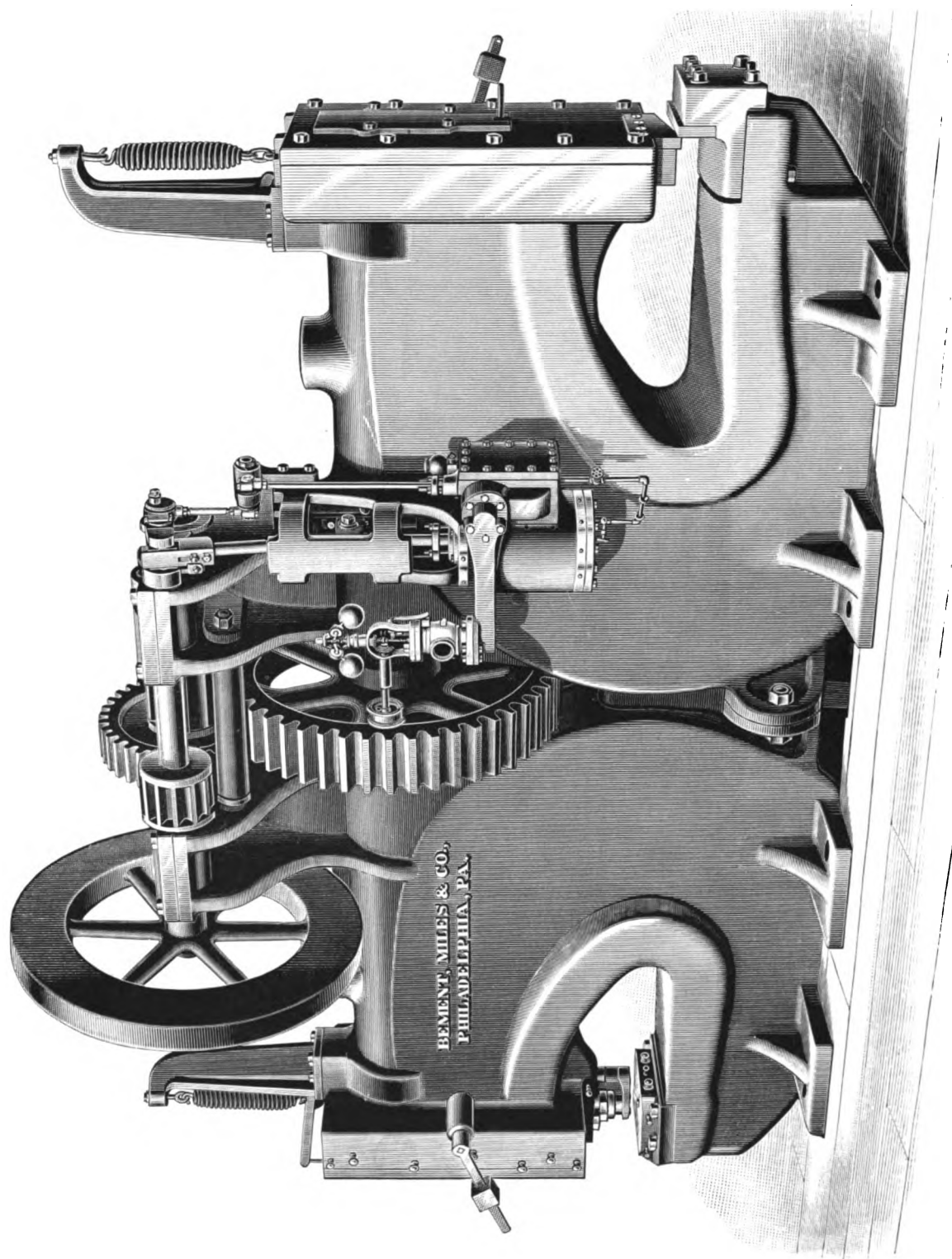
No. 7 PUNCHING MACHINE, 31-INCH THROAT.



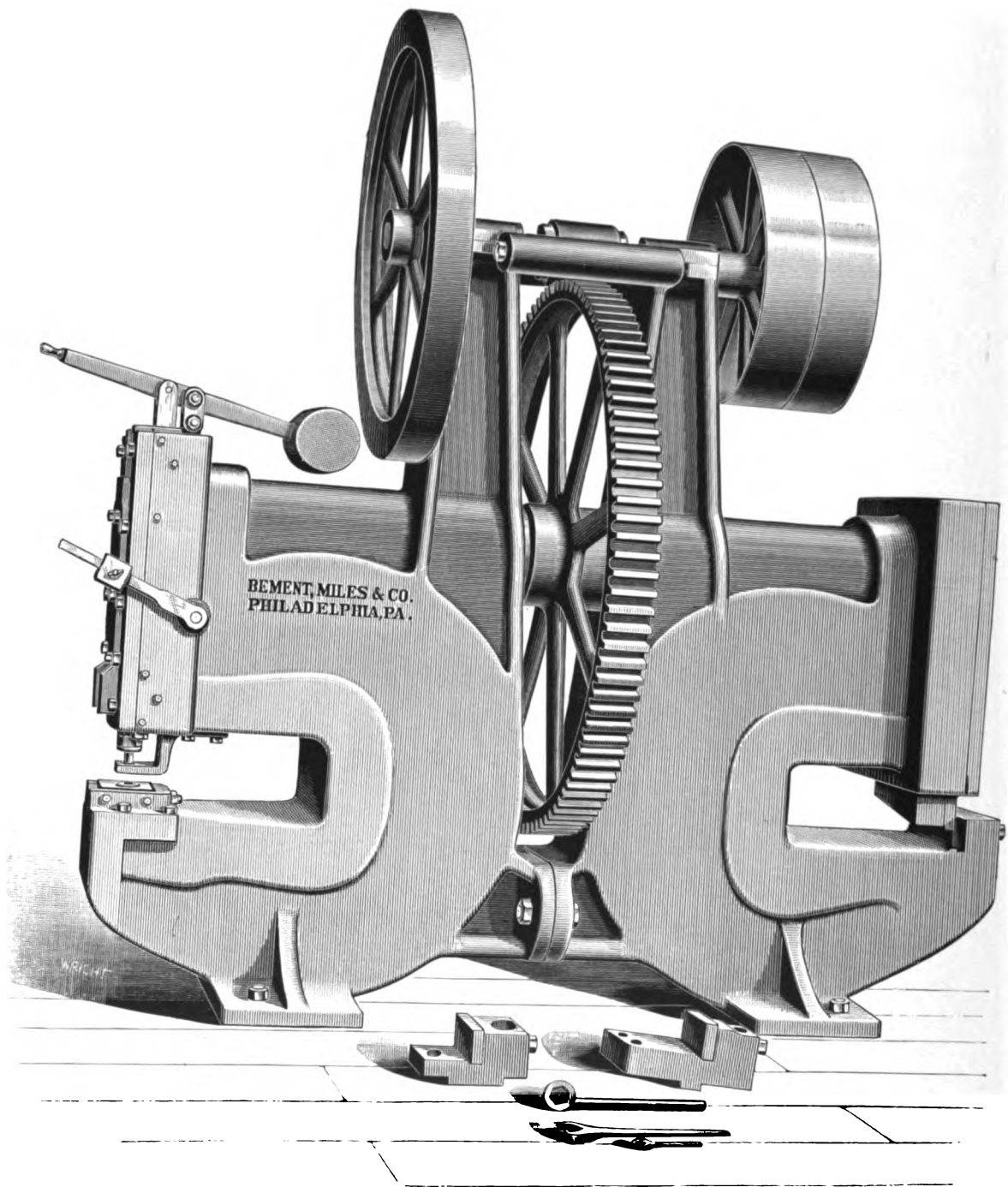
No. 7 PUNCHING MACHINE, 42-INCH THROAT



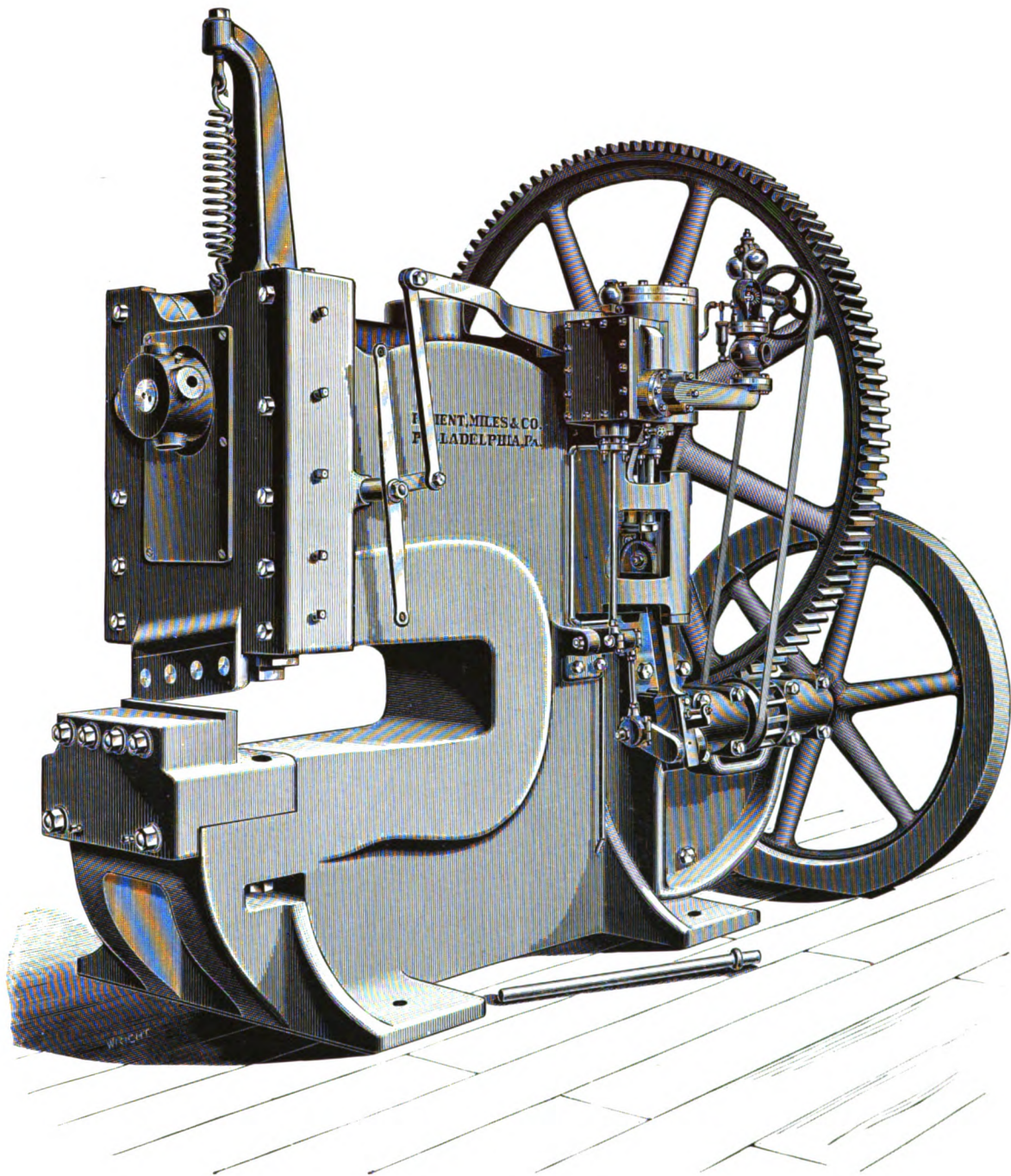
No. 8 PUNCHING MACHINE, WITH ENGINE.



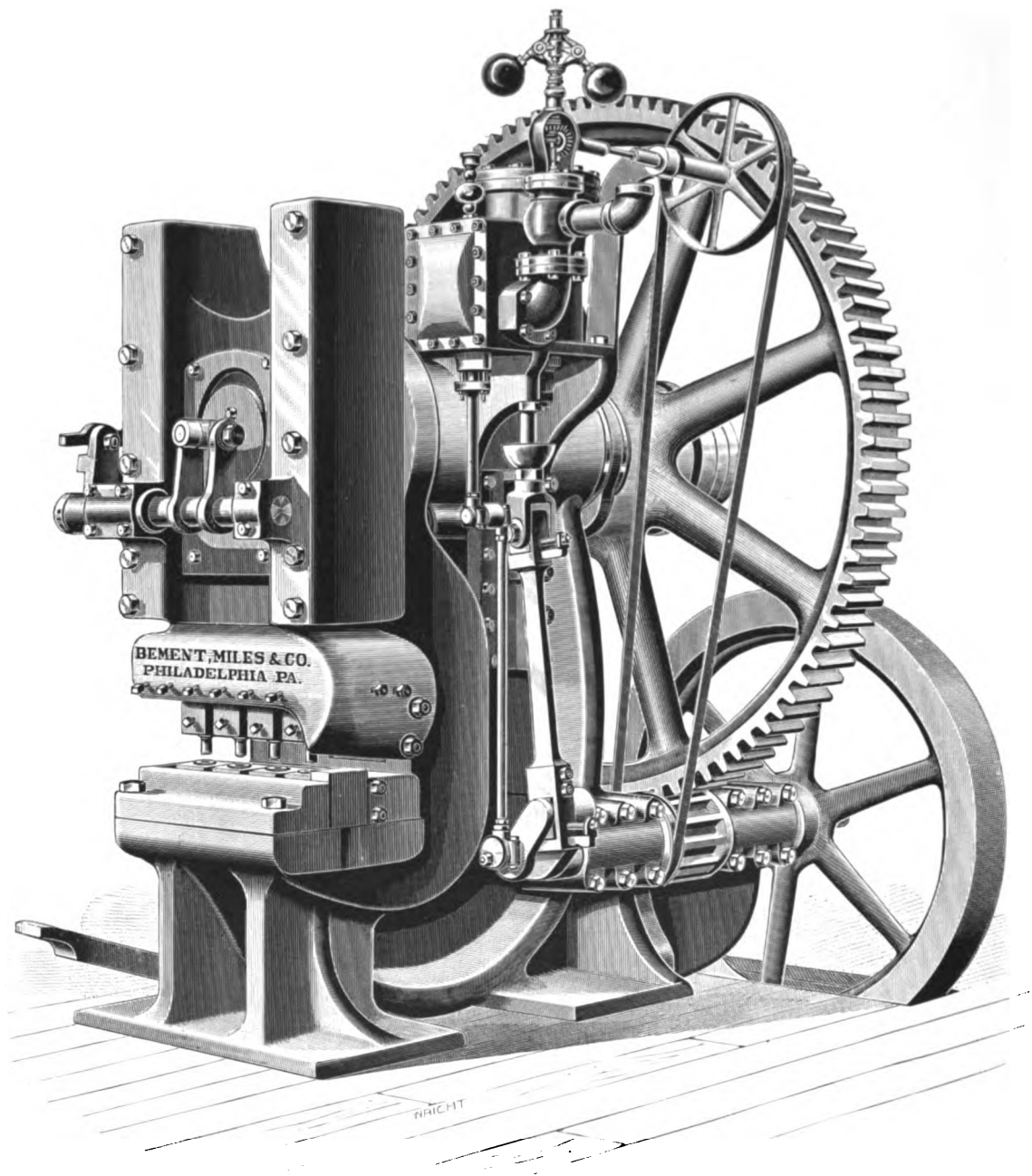
No. 8 PUNCHING AND SHEARING MACHINE, WITH ENGINE.



No. 10 PUNCHING AND SHEARING MACHINE.

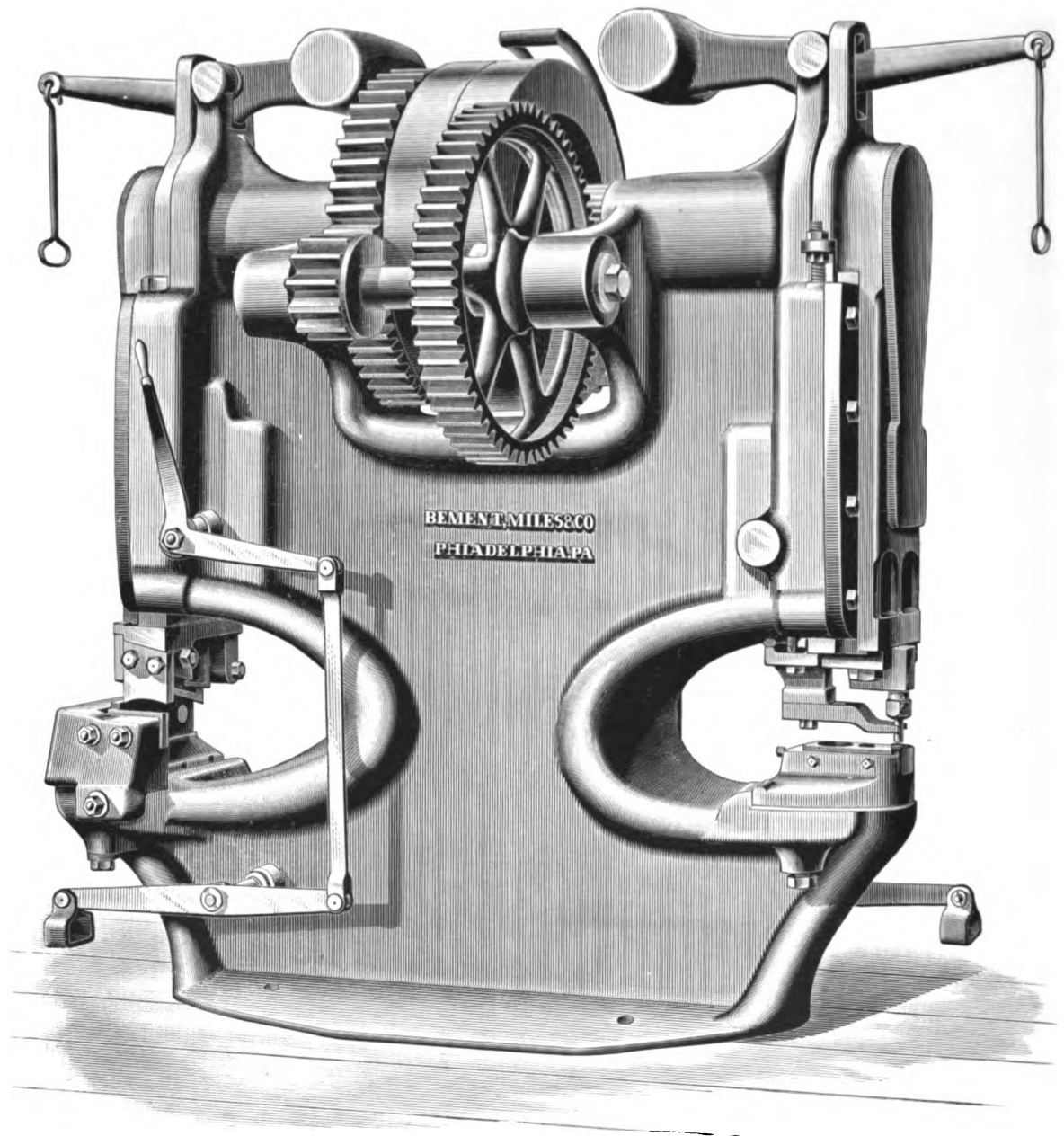


No. 13 SHEARING MACHINE, WITH ENGINE.



No. 14 PUNCHING MACHINE, WITH ENGINE.

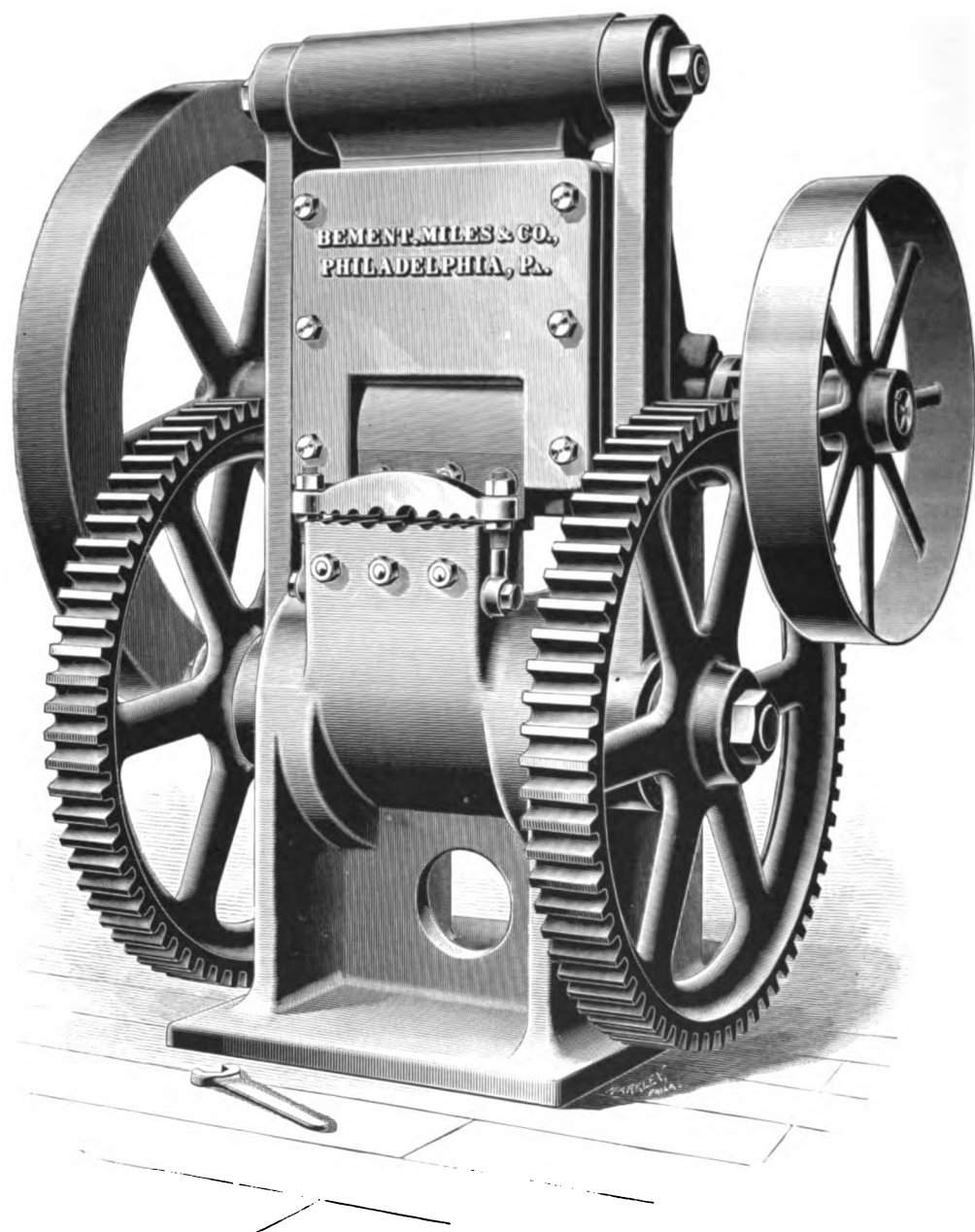
In addition to the foregoing, we are prepared to furnish Hydraulic Punching and Shearing Machines of all sizes, but have not been able to make any illustrations in time for this catalogue.



No. 16 COMBINED PUNCHING AND SHEARING MACHINE.

No. 16 COMBINED PUNCHING AND SHEARING MACHINE.

Will punch a $1\frac{1}{4}$ -inch hole in 1-inch iron, 21 inches from edge of sheet, and shear $\frac{7}{8}$ -inch plates, 24 inches from edge. Heads receive their movement from an eccentric shaft through a vibrating pintle, the end of which and the block on which it rests being of hardened steel. Each head is balanced, and each has an independent stop motion, operated by hand-lever and treadle. If desired, the treadles may be so weighted that the heads will disengage at every revolution of the shaft; also, by withdrawing the sliding block, the heads may be raised and lowered through the entire stroke by the rods attached to counterweights. This is of advantage in punching spaced or laid-out work. Has tight and loose pulleys, but no countershaft. Can be arranged for punching and plate shearing, punching and bar shearing, or all three operations.



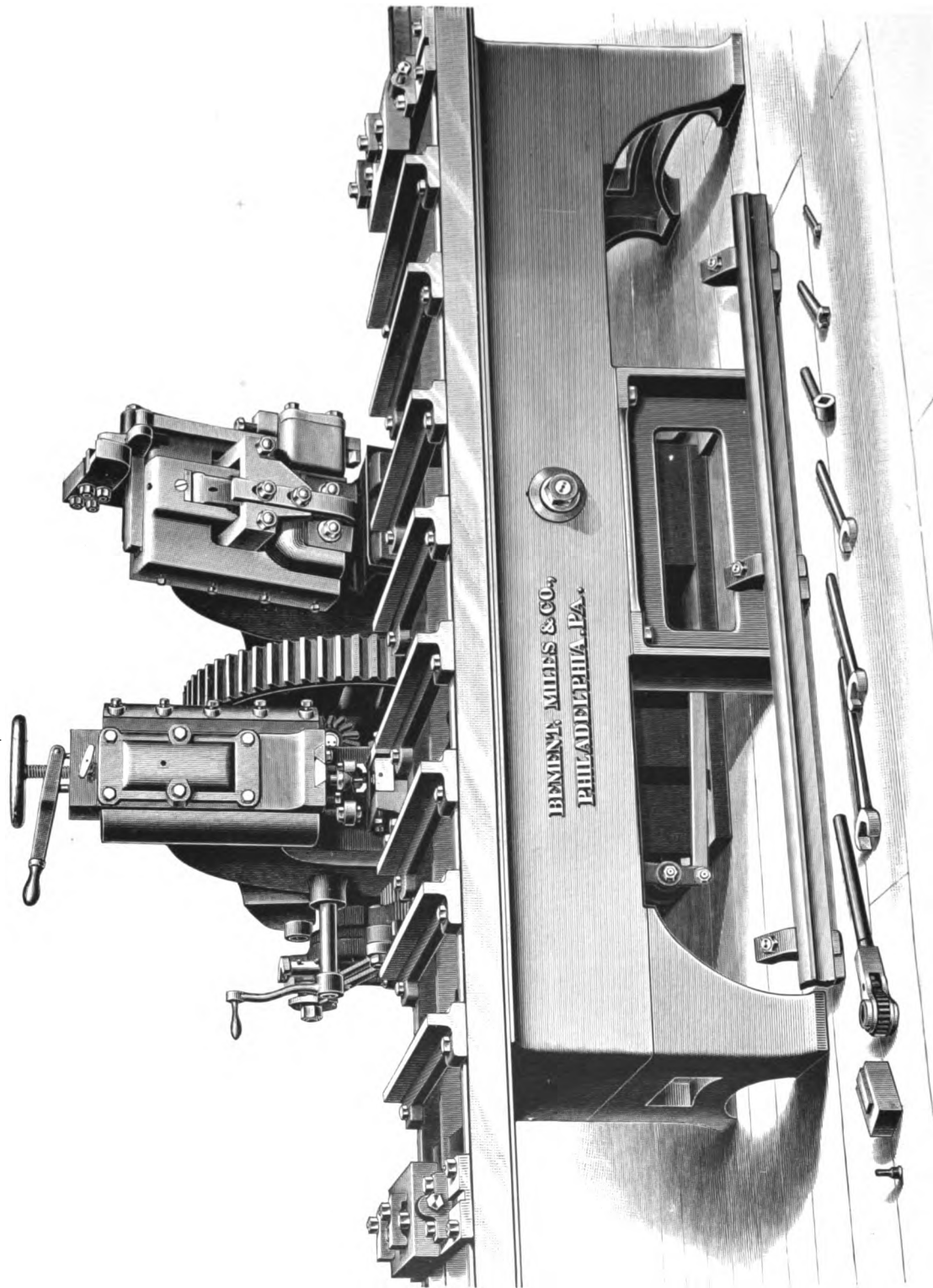
1 3/4-INCH BAR SHEARING MACHINE.

1 $\frac{1}{4}$ -INCH BAR IRON SHEARING MACHINE.

For cutting bars up to $1\frac{1}{4}$ -inch diameter, in lengths. Head receives its motion from an eccentric shaft, through parallel links, one attached to each side. A gauge, readily adjusted, is provided for cutting any lengths up to 3 feet. Countershaft has tight and loose pulleys, and two driving pulleys of different diameters, corresponding to two which are on the machine, giving a quicker movement for light bars, which can be handled rapidly.

1 $\frac{3}{4}$ -INCH BAR IRON SHEARING MACHINE.

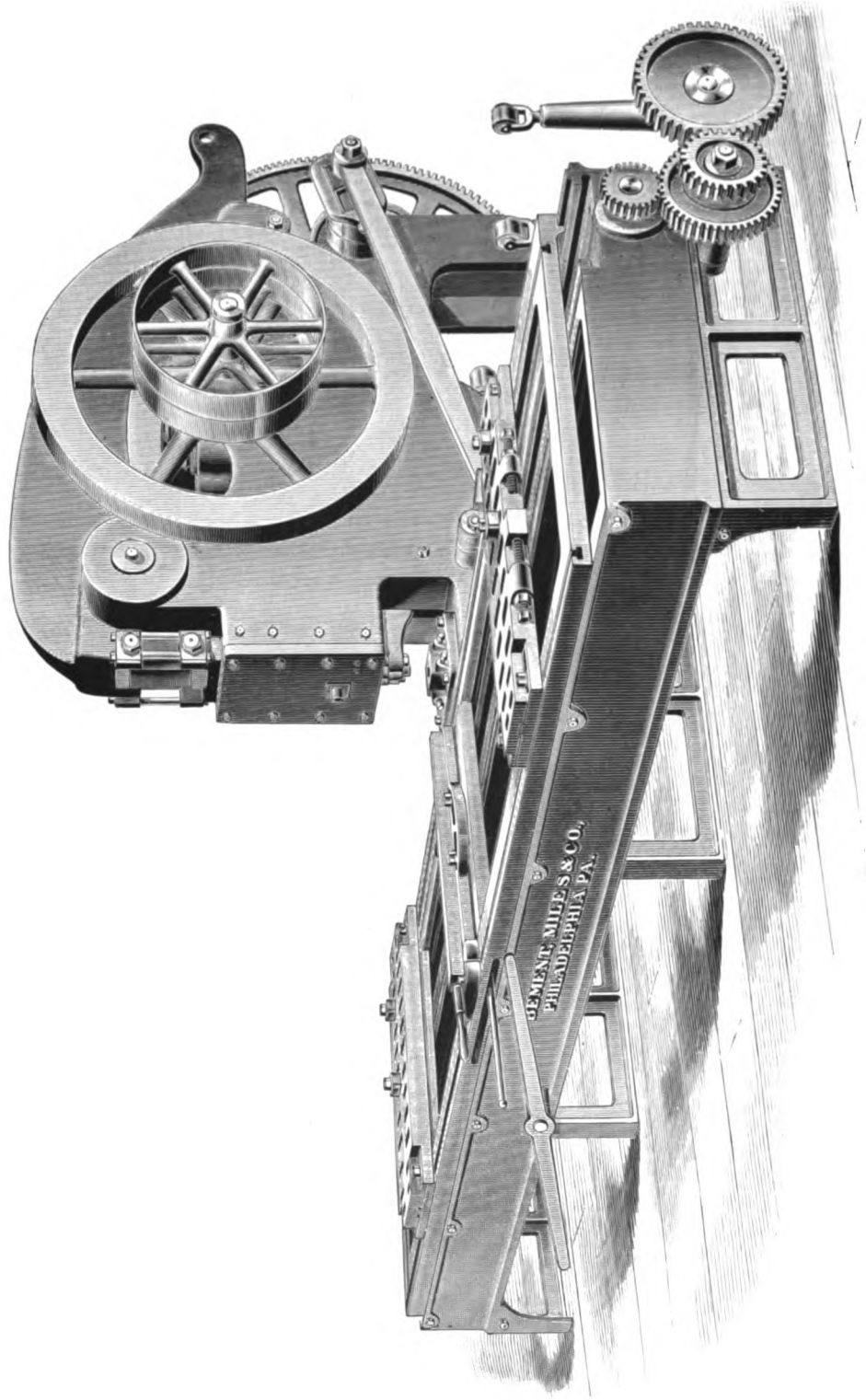
For shearing bar iron up to $1\frac{3}{4}$ inches in diameter. Head is driven on both sides by gears on eccentric shaft through a pair of connecting rods. Countershaft, having pulleys arranged to give two speeds to the machine, is included.



AUTOMATIC TANK PUNCHING AND SHEARING MACHINE.

AUTOMATIC TANK PUNCHING AND SHEARING MACHINE.

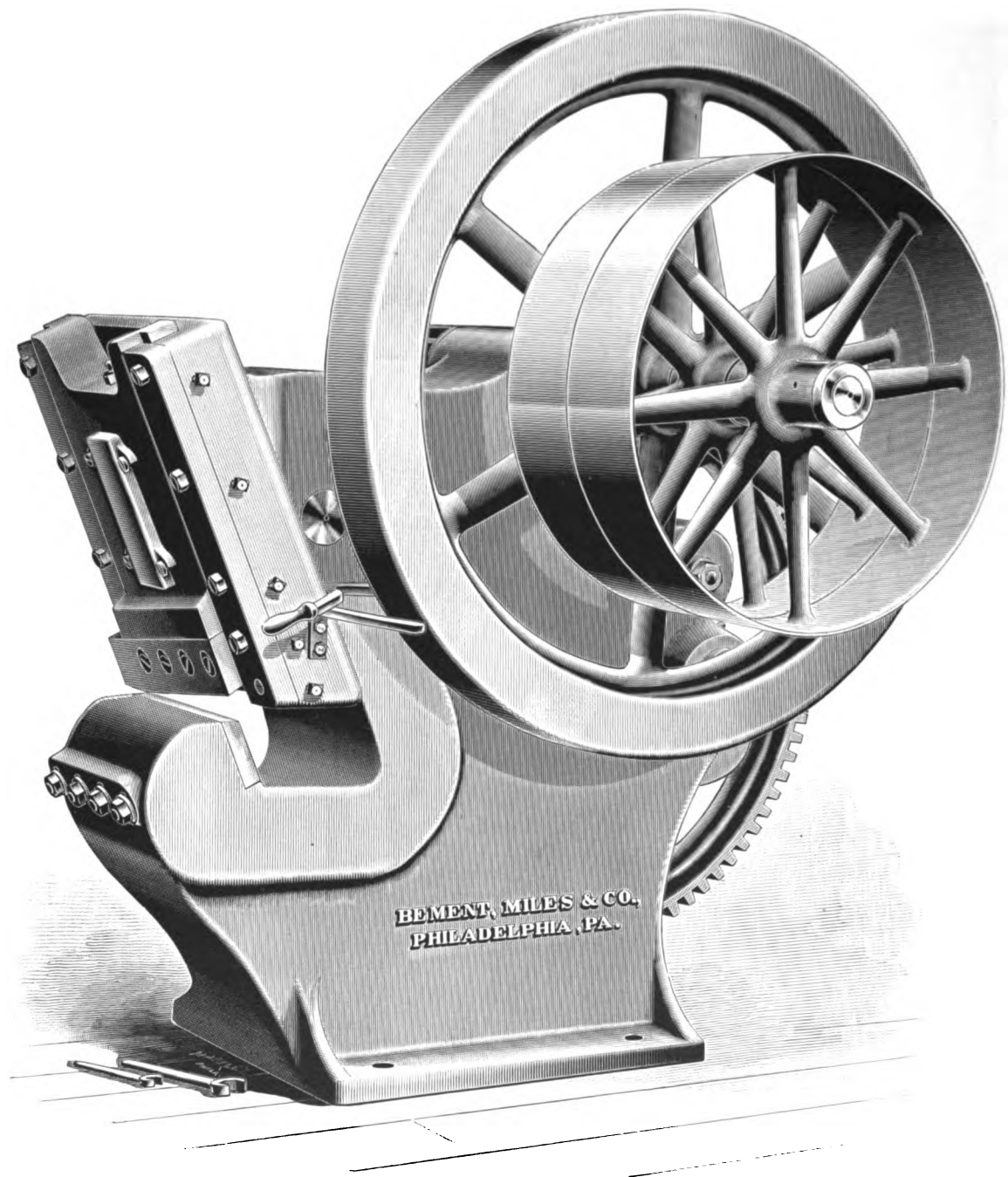
Will punch a $\frac{3}{8}$ -inch hole in $\frac{3}{8}$ -inch steel, dividing automatically by sixteenths up to 2 inches. Simultaneously with the punching, the edges of the sheets are trimmed at an angle of 70 degrees and at any required distance from the holes, the scrap being at the same time cut into short pieces by a cross shear. Punch can be brought down to the sheet for adjustment; shear blade can be raised when punching only is required, and both heads have a positive return motion by cams connected with the driving levers. Bed is usually made 43 feet long, and table 25 feet long, to accommodate a sheet 22 feet in length. The table has a rapid power movement in both directions.



PUNCHING MACHINE, WITH AUTOMATIC TABLE.

PUNCHING MACHINE WITH AUTOMATIC TABLE.

Will punch a 1-inch hole in $\frac{3}{4}$ inch iron, or its equivalent. Driven by pair of tight and loose pulleys, and provided also with clutch for starting and stopping head. Lever receives its motion from cam revolving against friction roller and is connected to punching slide by vibrating steel pintle, bearing on hardened steel surfaces, and provided with means of adjustment for wear. Stripper (adjustable to any thickness of iron) is operated automatically to hold sheet firmly while the punch cuts and returns, and rise while sheet is advanced. Table is arranged to hold iron of any width, and any length not exceeding 15 feet; also provided with means of shifting the sheet, without unclamping it, when two or more rows of holes are required. Table moved forward automatically while punch is withdrawn, by screw placed diagonally in bed, and moving table by nut fitted to slide in a transverse groove, the obliquity of which may be changed at pleasure, accelerating or retarding the movement of table relatively to that of nut. By this arrangement divisions of any possible length, not greater than 3 inches, can be readily and correctly obtained, and two sheets may be so punched that when rolled into circles and fitted together all the holes will exactly coincide.



BEVEL SHEARING MACHINE.

BEVEL SHEARING MACHINE.

Will shear $\frac{3}{4}$ -inch plates at an angle of 65 degrees. Depth of throat, 10 inches. Operated by a cam against a roller in a wrought-iron lever, which bears upon a steel block in the head. Stopping and starting of head is effected by a hand lever (or treadle) connected with a clutch on cam shaft, the stopping always leaving the head at upper end of stroke. Length of shear blade, 17 inches.



No. 2 HORIZONTAL PUNCHING AND BEAM BENDING MACHINE.

No. 1 HORIZONTAL PUNCHING MACHINE.

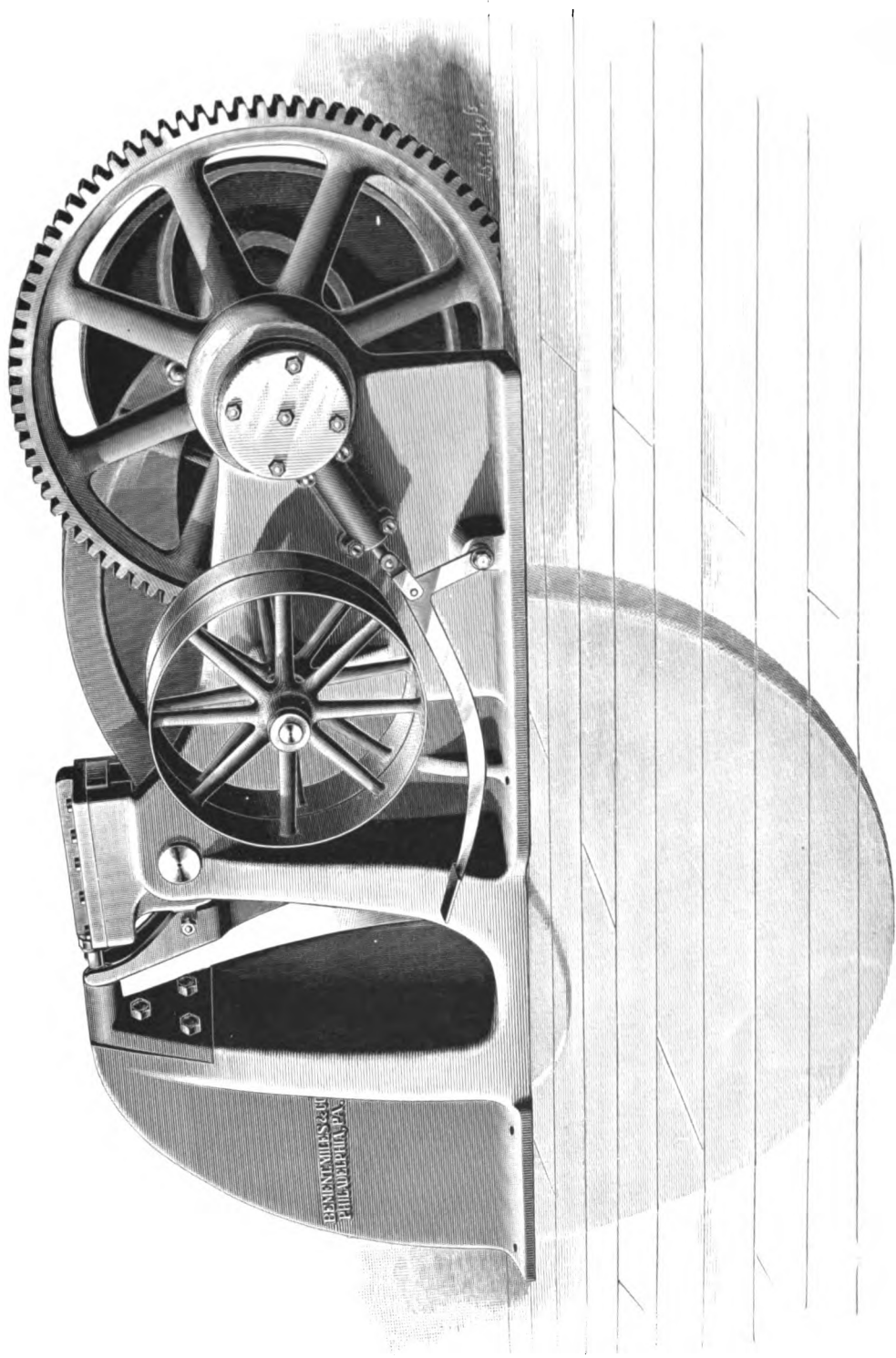
Will punch a 1-inch hole in $\frac{3}{4}$ -inch iron at a distance of 1 inch from edge of frame. Depth of throat, 6 inches. Head is of wrought iron, started and stopped by hand lever connected with clutch on eccentric shaft; and receives its motion through a pintle of steel and iron, bearing upon a steel block, the surfaces in contact being hardened. Sample punch and die, with the necessary holders included.

No. 2 HORIZONTAL PUNCHING MACHINE.

Will punch a $1\frac{1}{4}$ -inch hole in 1-inch iron. Depth of throat 12 inches, and distance from centre of punch to top of stake 1 inch. Plunger is of wrought iron, driven by an eccentric shaft through a vibrating pintle, the surfaces between the pintle and the plunger being of hardened steel. The stopping and starting are effected by a clutch on eccentric shaft. The punches, which are simple in form, are held in position by a threaded cap of wrought iron, which also affords an adjustment for wear of the punches. Sample punch and die, with holder, included.

No. 3 HORIZONTAL PUNCHING MACHINE.

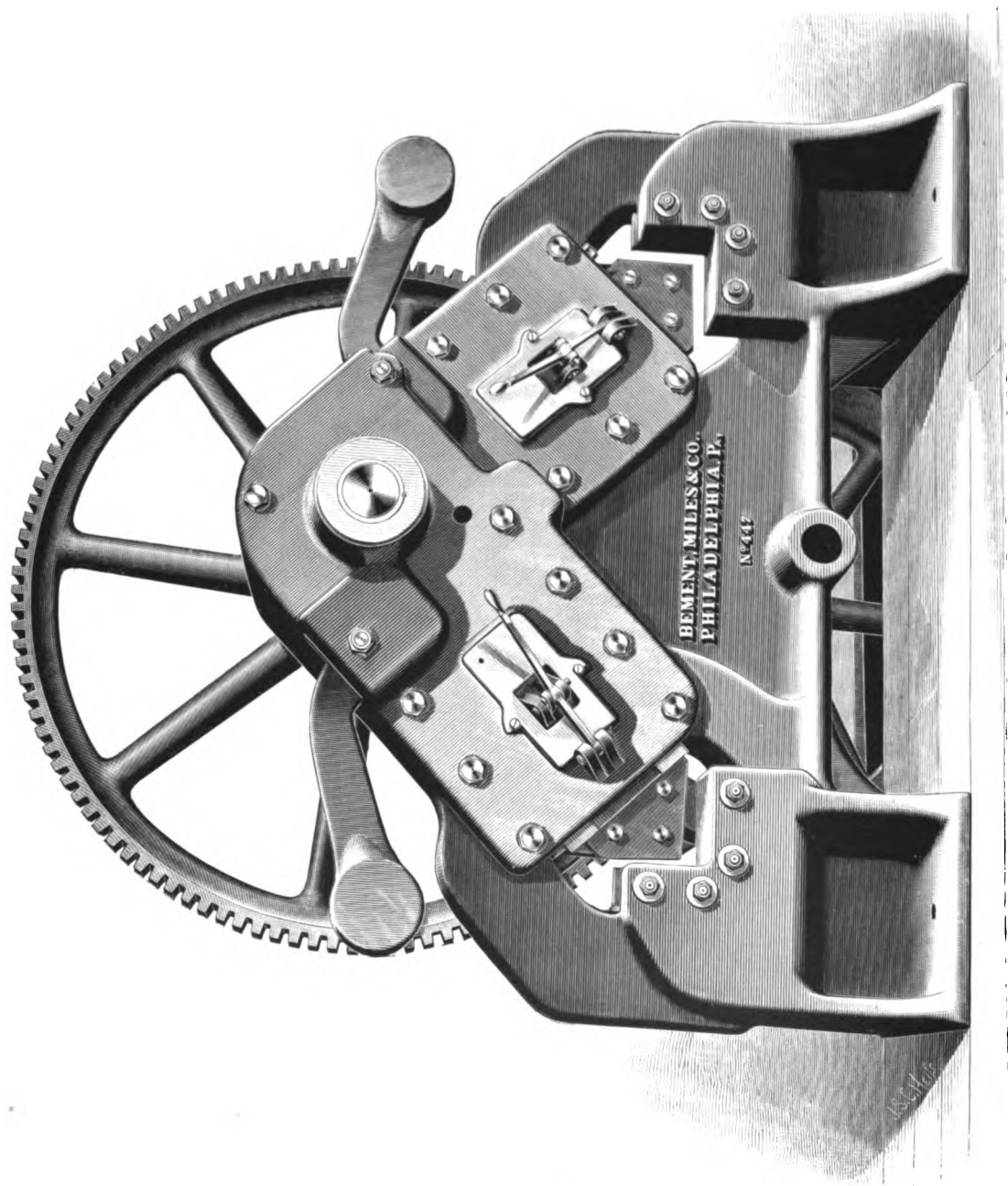
Will punch a $1\frac{1}{2}$ -inch hole in $1\frac{1}{2}$ -inch iron. Depth of throat 10 inches, and distance from centre of punch to top of steel stake $1\frac{1}{4}$ inches. Head is of wrought iron, driven by an eccentric shaft and vibrating pintle having hardened steel bearing surfaces. Stopping and starting of head are effected by clutch on eccentric shaft. The punches, which are simple in form, are held in position by threaded cap of wrought iron, which also affords an adjustment for wear of punches. Sample punch and die, with holder, included. All of the horizontal punching machines may be provided with a beam bending attachment.



No. 4 HORIZONTAL PUNCHING MACHINE.

No. 4 HORIZONTAL PUNCHING MACHINE.

Will punch a 2-inch hole in 1-inch plate. Depth of throat 60 inches, and usual distance from centre of punch to edge of frame $2\frac{1}{4}$ inches. The machine is started and stopped by a treadle; and the plunger, which is of wrought iron, is operated by a cam and lever with a positive return motion. The bearing surfaces between the plunger and lever are made of phosphor-bronze. An automatic stop is provided by which the return movement of the plunger may be arrested at any point of its stroke. The stripper is adjustable to any thickness of plate. The punches, which are simple in form, are held in position by a threaded cap of wrought iron, which also affords an adjustment for wear of the punches. Sample punch and die, with holder, included.



No. 2 DOUBLE ANGLE IRON SHEARING MACHINE.

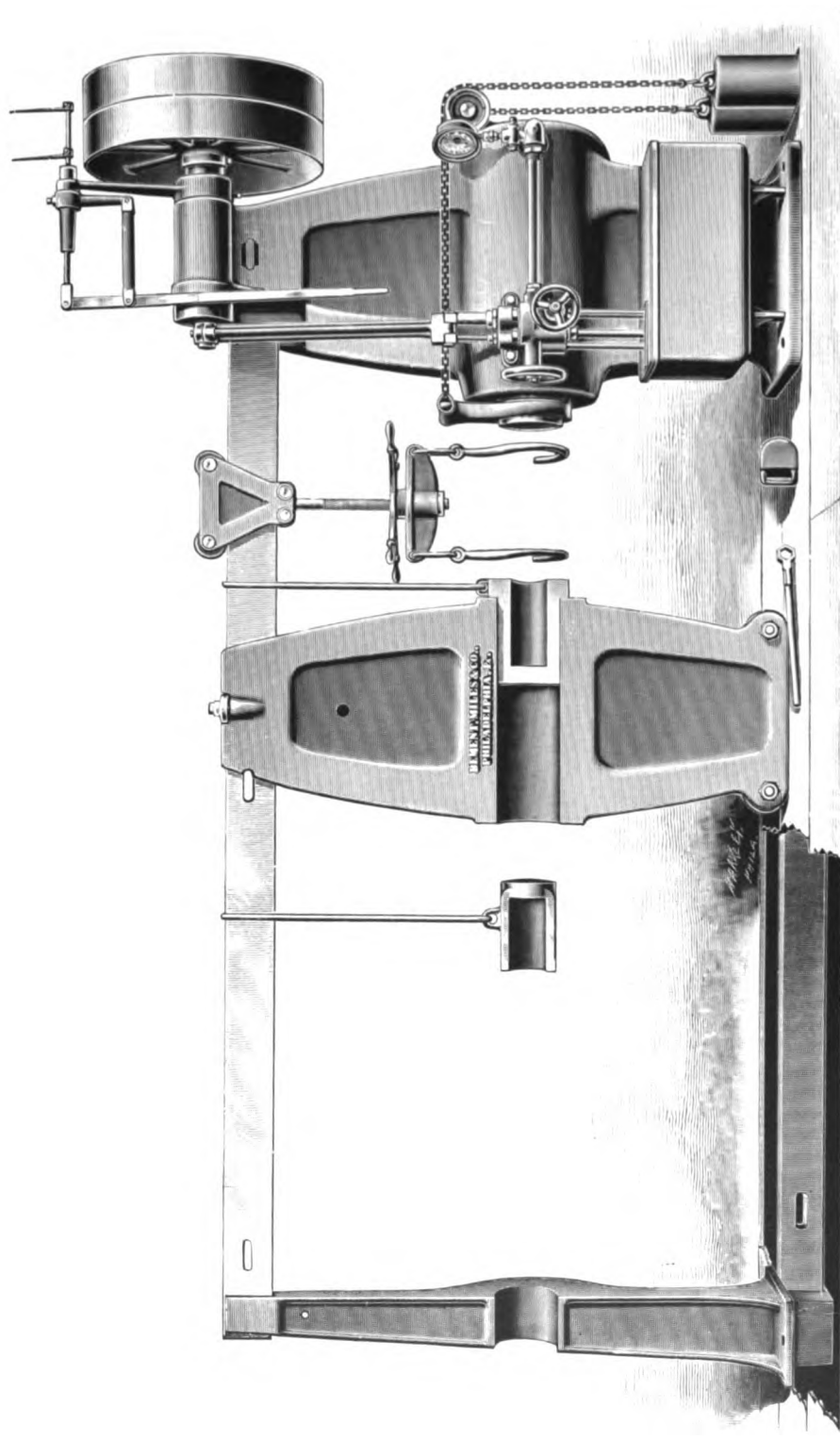
No. 2 DOUBLE ANGLE IRON SHEARING MACHINE.

Will shear 6-inch by 8-inch angle iron. Plungers are driven by an eccentric shaft through vibrating pintles, the points on which, and the blocks on which they rest, are of hardened steel. Each plunger is independently started and stopped by a hand lever. A sample pair of shears, for each side of the machine, included.

Hydraulic Machinery,

... INCLUDING ...

Steam and Hydraulic Riveters

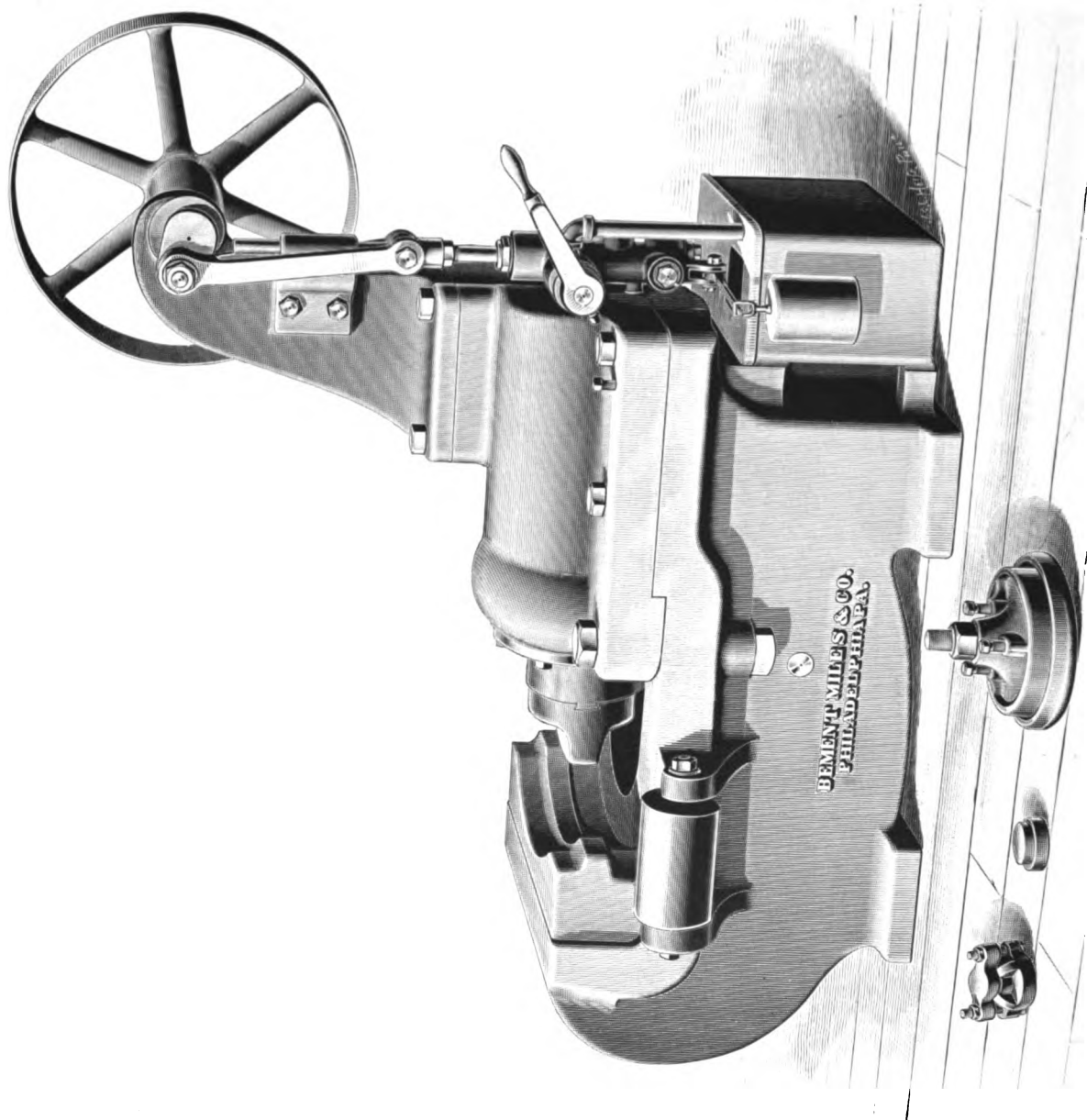


84-INCH HYDRAULIC WHEEL PRESS.

HYDRAULIC WHEEL PRESSES.

30-inch. 38-inch. 46-inch. 54-inch. 78-inch. 84-inch. 90-inch. 100-inch.

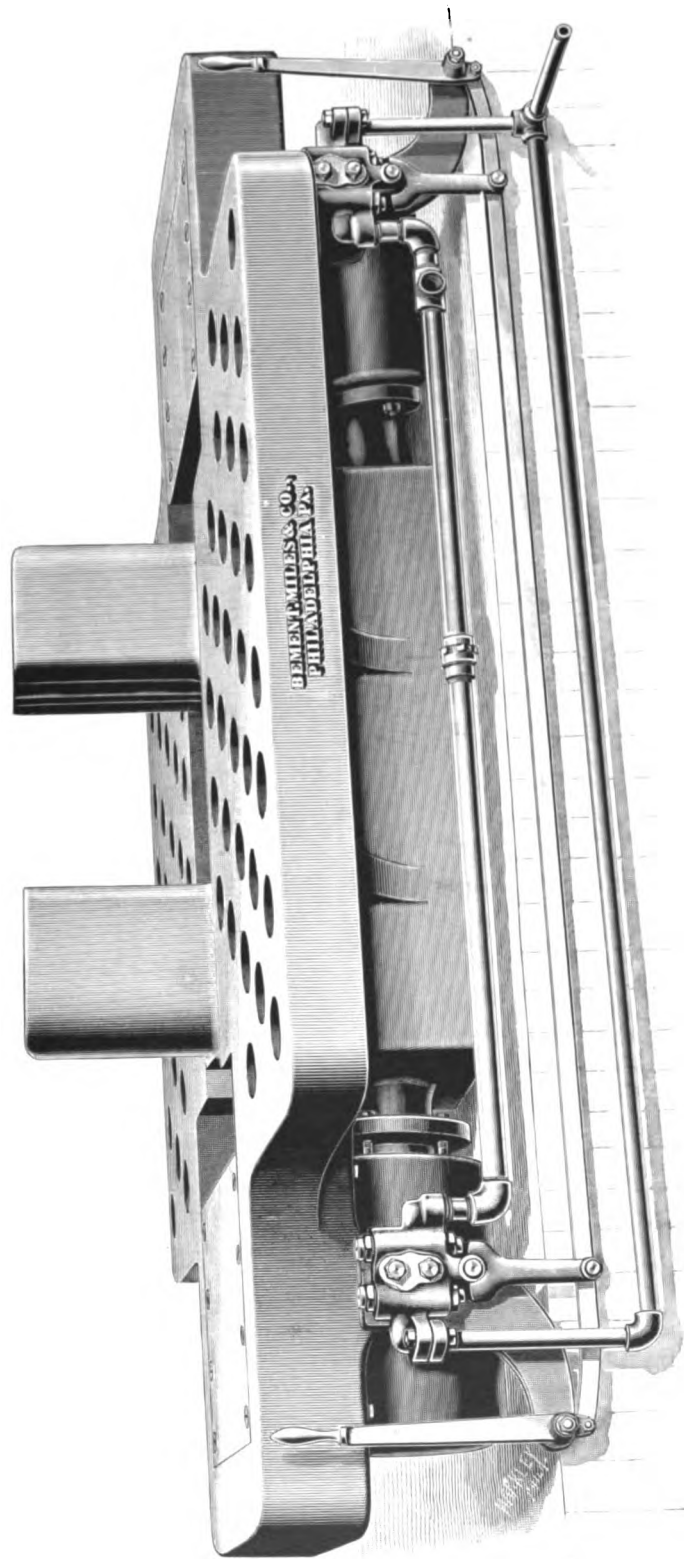
These machines are built of various capacities, from 100 to 300 tons pressure, and of dimensions adapted to the different sized wheels in use, such as narrow gauge car, tender and driving wheels; ordinary 33-inch and 36-inch car wheels, 42-inch wheels, 5, 6 and 7-foot driving wheels, etc. They are all fitted with double pumps to save time in despatching work, driven from large pulleys with wide belts. Both pumps—operated by a single crank and connecting rod—are used for moving the ram rapidly, or for light pressures. When the pressure becomes too great for both pumps, the large one may be instantly disconnected without stopping the movement of the ram, which, being then driven by the small pump alone, goes on with the full power of the machine to the maximum pressure. The rams, which are of large diameter and unusual length of traverse, are drawn back rapidly by weights, whose chains are so attached and arranged as to support the projecting part of the rams. The hand wheel for letting off the pressure is placed at the side of the machine, where it can be conveniently reached by the workman. The movable post is supported upon rollers for easy adjustment. The belt shifter is universal; that is, the belt may be used at any angle and the shifter lever located in the most convenient position for handling. All the cylinders are copper lined. A convenient lifting screw and cradle for handling the axles, a correct pressure gauge, a reservoir, counterweights and a mould for leather packing, are furnished with each machine.



HYDRAULIC RAIL BENDING MACHINE.

HYDRAULIC RAIL BENDING MACHINE.

Has ample power to make short bends in the heaviest rails. Pump is double acting and of liberal capacity, moving the ram to its work rapidly. Regulating lever conveniently placed, by which the bending movement can be made as slow as desired or instantly stopped; the pump meanwhile running continuously. Rollers, adjustable in height, provided for supporting the rail. Bending blocks can be readily changed when required. Each machine thoroughly tested before leaving the works.

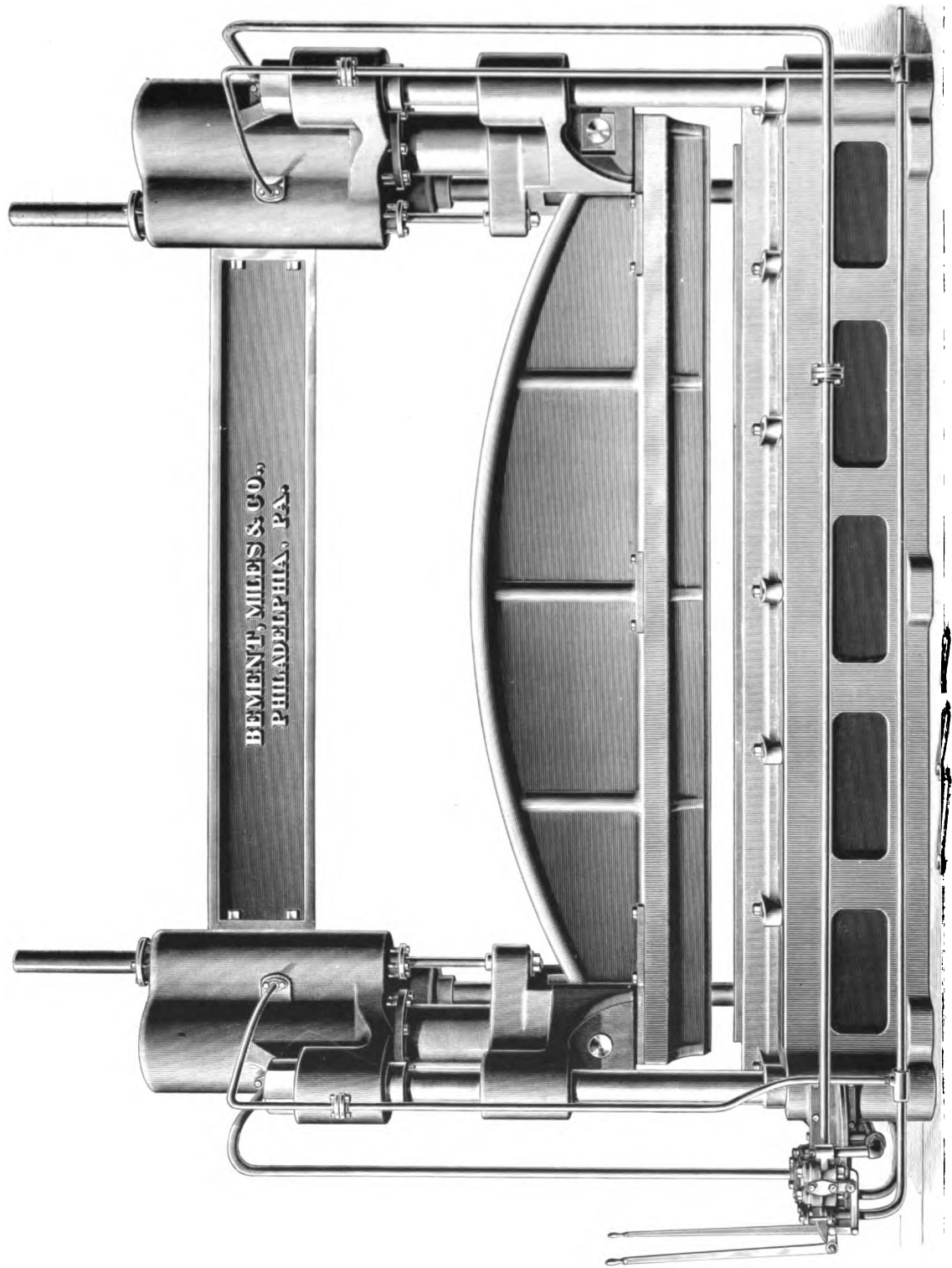


HYDRAULIC BEAM AND ANGLE BENDING MACHINE.

HYDRAULIC BEAM AND ANGLE BENDING MACHINE.

For beams up to 12 inches in depth. Rams and bending jaws in one piece, operated by cylinders at both ends 12 inches in diameter, for any stroke up to 10 inches. Clamping plate 8 feet wide, and length of machine 10 feet 6 inches. Valves included.

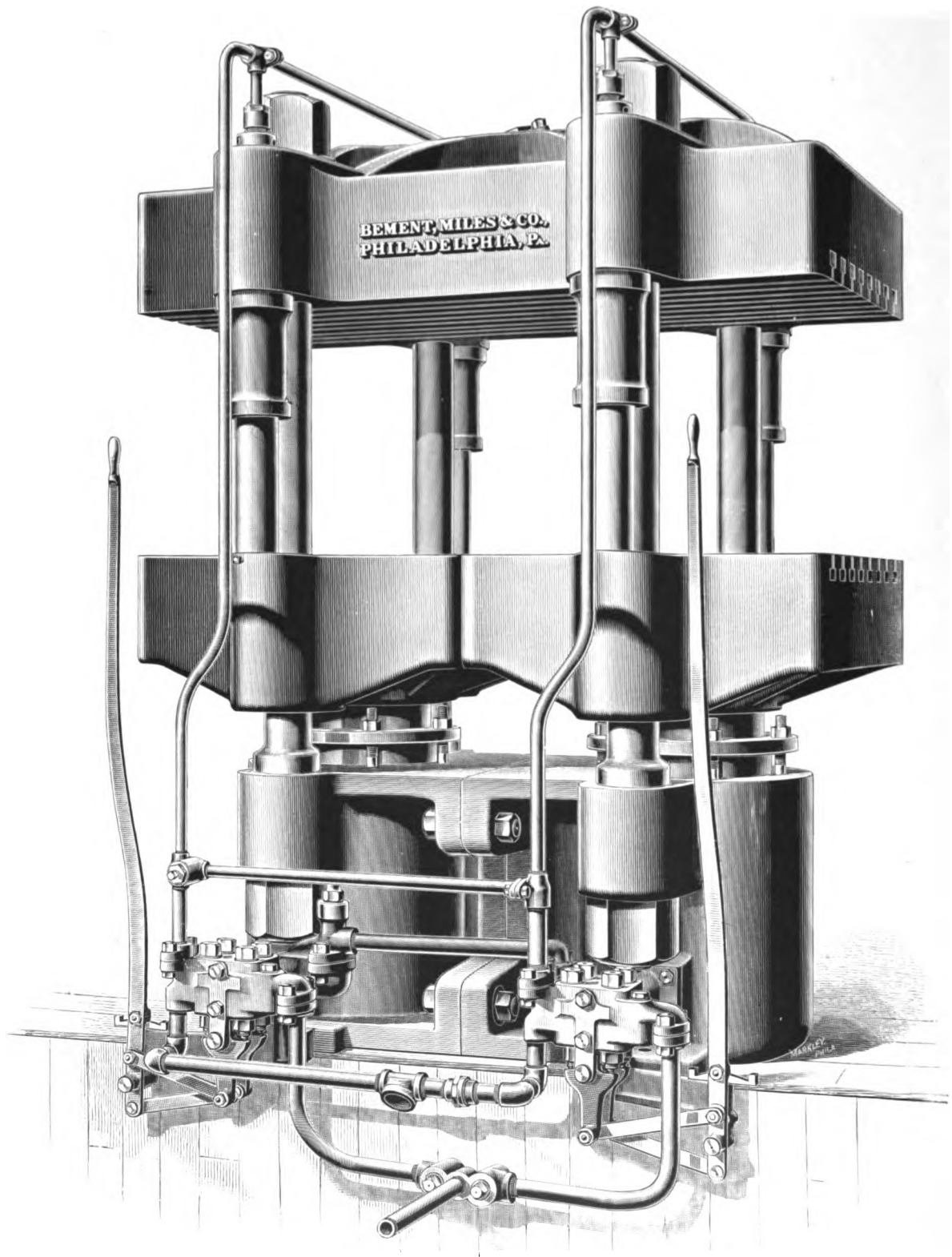
Larger machines than the above will be furnished, if required.



UNIVERSAL HYDRAULIC BENDING MACHINE.

UNIVERSAL HYDRAULIC BENDING MACHINE.

For keels, garboard streaks, sponsons, deck plates, masts, and miscellaneous irregular plate work up to 3 inches in thickness. Usual clear space between bolts, 16 feet 2 inches long by 6 feet 2 inches wide, which may be modified as required. Cylinders 14 inches diameter by 30 inches stroke, giving a net pressure of 200 tons at 1500 pounds per square inch. Both ends of beam may be operated together, or either end independently, for irregular work. Pull back plungers for return motion of clamping beam always open to accumulator. Valves and a sample former included.



36-INCH HYDRAULIC PRESS—DOUBLE.

32-INCH HYDRAULIC PRESS.

Distance between columns 32 inches, and usual vertical working distance 30 inches. Cylinder 12 inches in diameter, with 15 inches stroke. Net pressure 50 tons at 1000 pounds per square inch, if constructed as a single press, or 100 tons if made double. Backing plungers provided for return stroke. Valves and piping, as shown by illustration, included.

36-INCH HYDRAULIC PRESS.

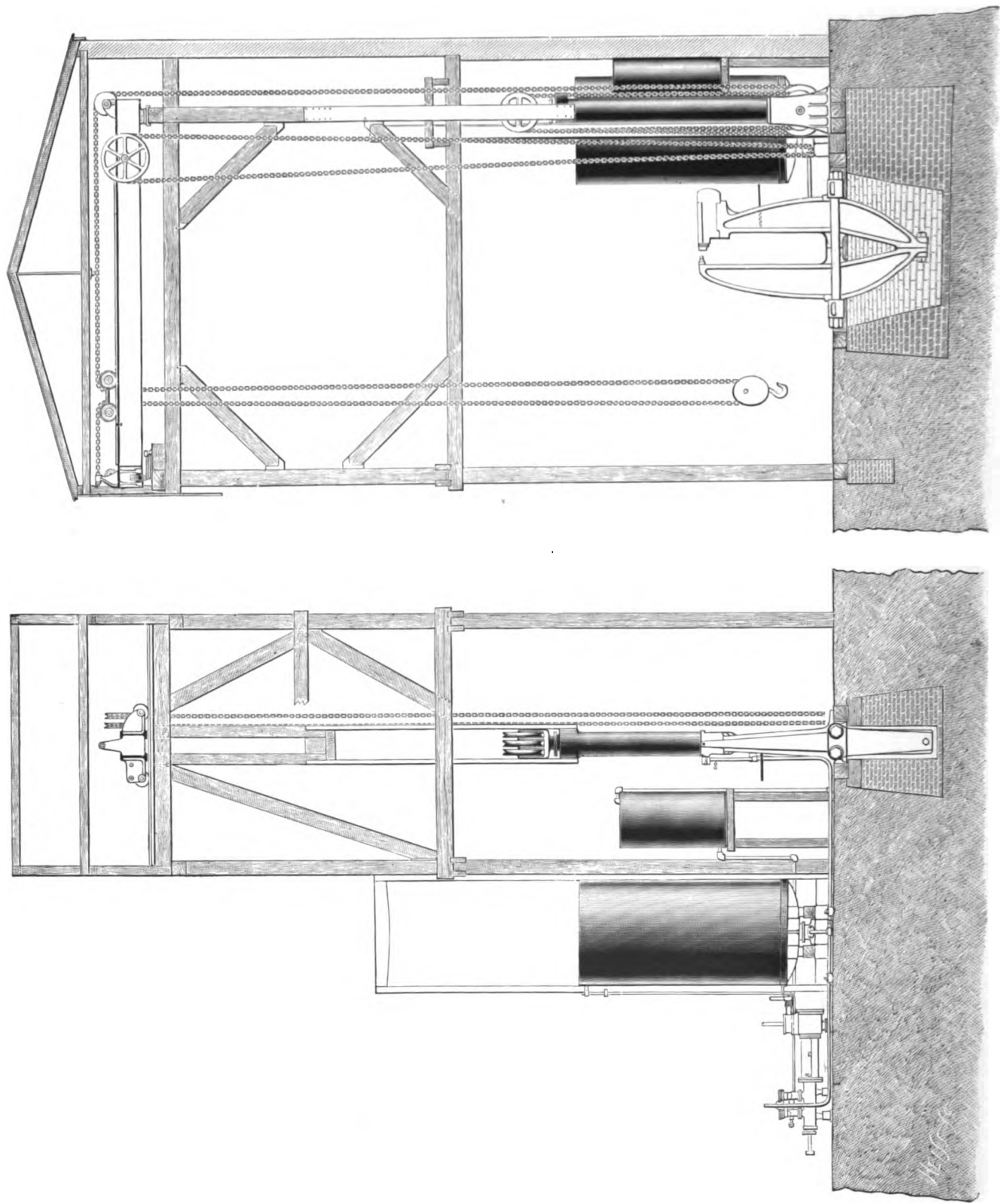
Distance between columns 36 inches, and usual vertical working distance 30 inches. Diameter of cylinder 17 inches, and stroke 15 inches. Net pressure 100 tons at 1000 pounds per square inch, if constructed as a single press, or 200 tons if made double. Backing plungers provided for return stroke. Valves and piping, as shown by illustration, included.



8-FOOT HYDRAULIC FLANGING PRESS.

8-FOOT HYDRAULIC FLANGING PRESS.

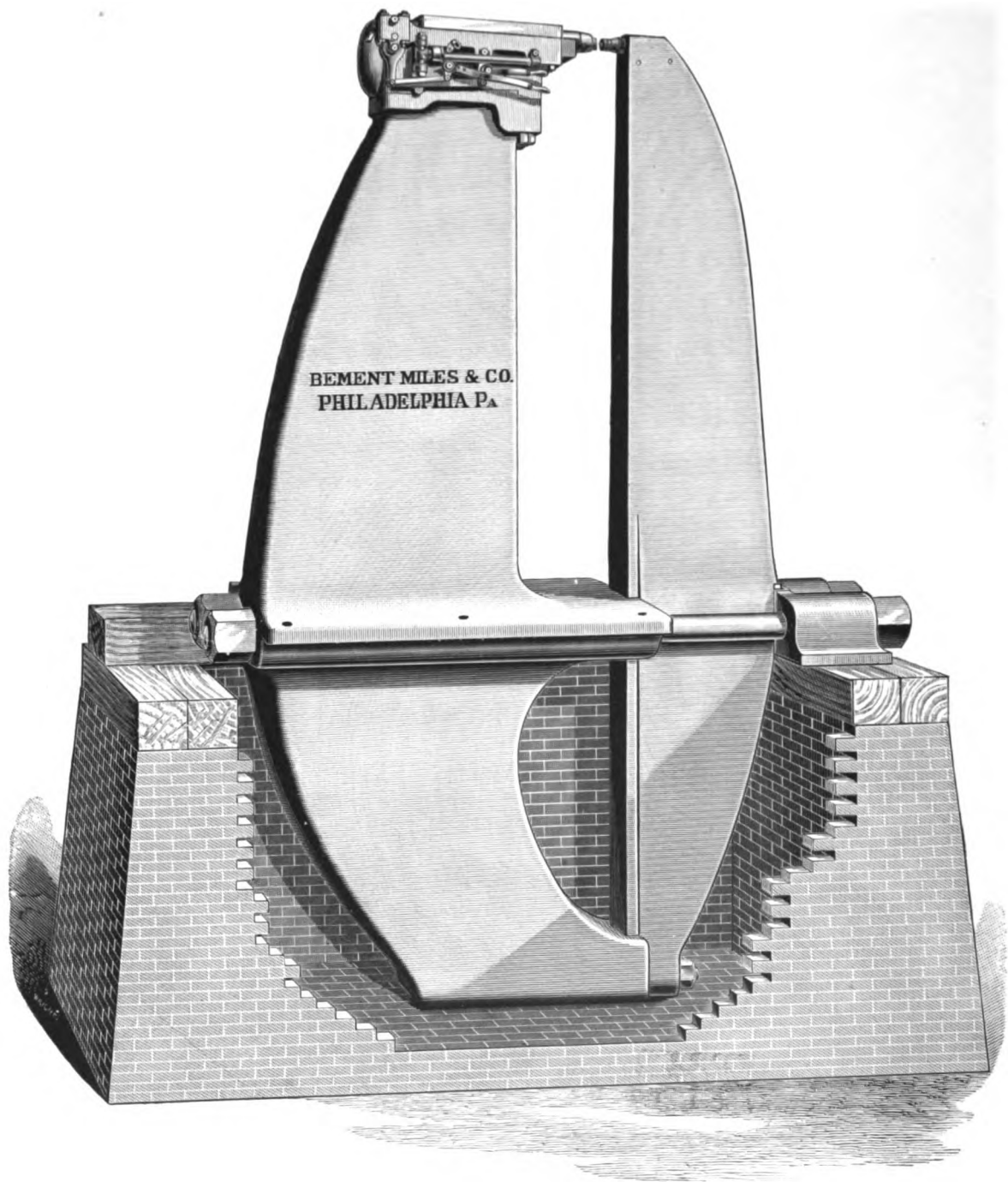
Clear space between bolts 8 feet 2 inches, and greatest distance from table to caps 7 feet 6 inches. Usual pressure 300 tons at 1000 pounds per square inch. Main cylinder is 28 inches diameter for 4 feet stroke, and cylinder for clamping bar is 14 inches diameter for 5 feet 6 inches stroke. The dimensions of the machine and the pressure may be varied to some extent, if required.



GENERAL ARRANGEMENT OF HYDRAULIC RIVETING PLANT.

RIVETING MACHINERY.

We build an extensive series of riveters, both steam and hydraulic, with a variation in depth of gap from 3 feet to 17 feet, and with every required pressure from 30 to 150 tons. The illustration on the opposite page represents somewhat in outline a hydraulic riveting plant, including the machine proper, hydraulic crane, accumulator, with its supply tank, and the duplex steam pressure pump for working the accumulator. The riveting machines are built with cast iron frames, and wrought iron stakes, or with steel stakes. All the hydraulic riveters have steel cylinders. If preferred, the whole machine can be made of steel of high tensile strength, effecting a saving in the weight, and consequently in the cost of shipping, as well as permitting a smaller flue to pass over the stake. Where some of the work to be done is too small for the usual stake, we provide a supplementary one which can be readily applied, or removed, and of which an illustration is given. The hydraulic cranes are made of different sizes, to handle weights from 5 tons to 40 tons, and of any desired height of lift. They are made with a radial jib, or with rectangular movements of bridge and trolley. The accumulators are built with rams, varying from 5 inches to 14 inches in diameter, with a vertical movement of from 3 feet to 18 feet. We also build double pressure pumps of different sizes, driven by belt, but usually furnish a duplex steam pump. Inquiries for hydraulic riveting machinery should give the thickness of plate, and size of rivet to be driven, the width of sheet to be worked, the weight to be lifted by the crane, as well as the highest required position of crane hook, the traverse of the trolley in both directions; and the additional machinery, if any, which is to be supplied with power by the accumulator.



96-INCH HYDRAULIC RIVETING MACHINE.

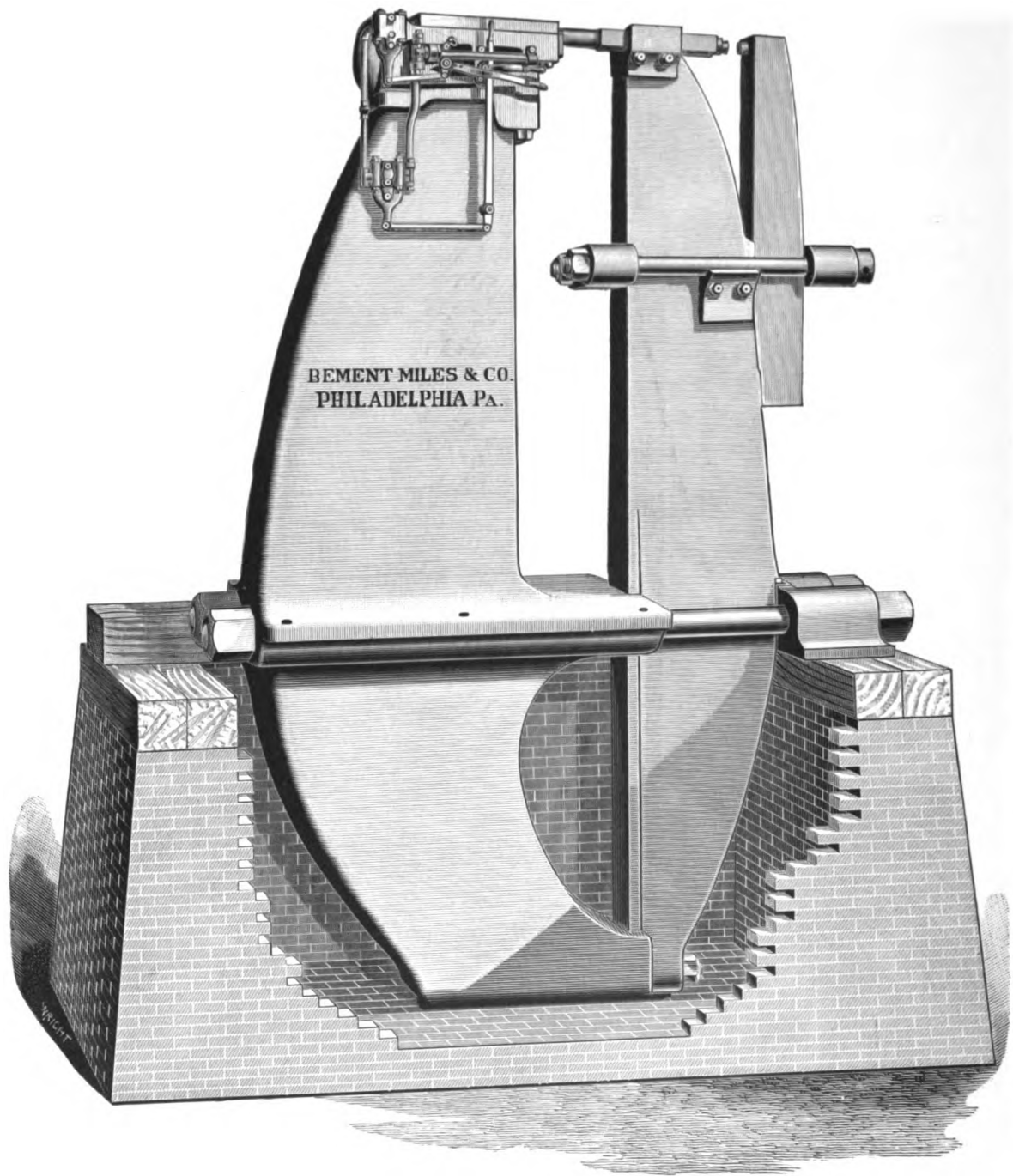
72-INCH HYDRAULIC RIVETING MACHINE.

Can be built for any pressure from 50 to 100 tons, with or without a plate closing attachment. Distance from centre of die to bottom of opening, 74 inches. Cylinder and ram are both of steel, with flat upper surfaces, allowing flanged plates of any dimensions to be riveted in any position. Riveting ram is of rectangular section, permitting the use of offset dies when required. Valves are simple in construction, and are operated by a single movement of a hand lever. Stroke is adjustable in length, economizing water when the full length of movement is not required. Stake is of wrought iron (or steel), held to frame by large bolts, and can be arranged to receive a supplementary stake for riveting small flues, if desired.

NOTE.—Any of our Riveting Machines will be built with steel frame and stake, if so ordered.

96-INCH HYDRAULIC RIVETING MACHINE.

Can be built for any pressure from 50 to 150 tons, with or without a plate closing attachment. Distance from centre of die to bottom of opening, 98 inches. Cylinder and ram are both of steel, with flat upper surfaces, allowing flanged plates of any dimensions to be riveted in any position. Riveting ram is of rectangular section, permitting the use of offset dies when required. Valves are simple in construction, and are operated by a single movement of a hand lever. Stroke is adjustable in length, economizing water when the full length of movement is not required. Stake is of wrought iron (or steel), held to frame by large bolts, and can be arranged to receive a supplementary stake for riveting small flues, if desired.

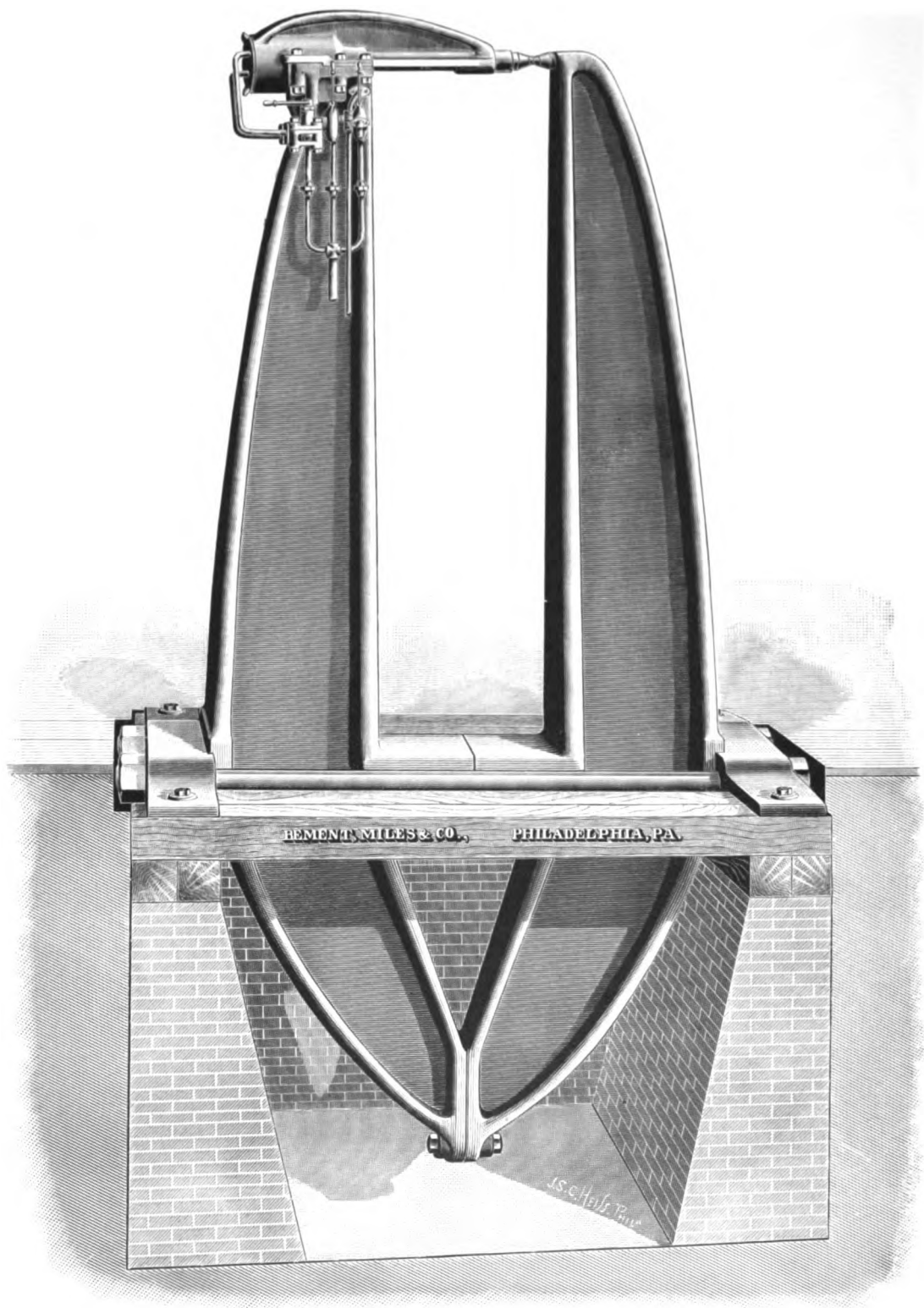


120-INCH HYDRAULIC RIVETING MACHINE, WITH SUPPLEMENTARY STAKE.

120-INCH HYDRAULIC RIVETING MACHINE.

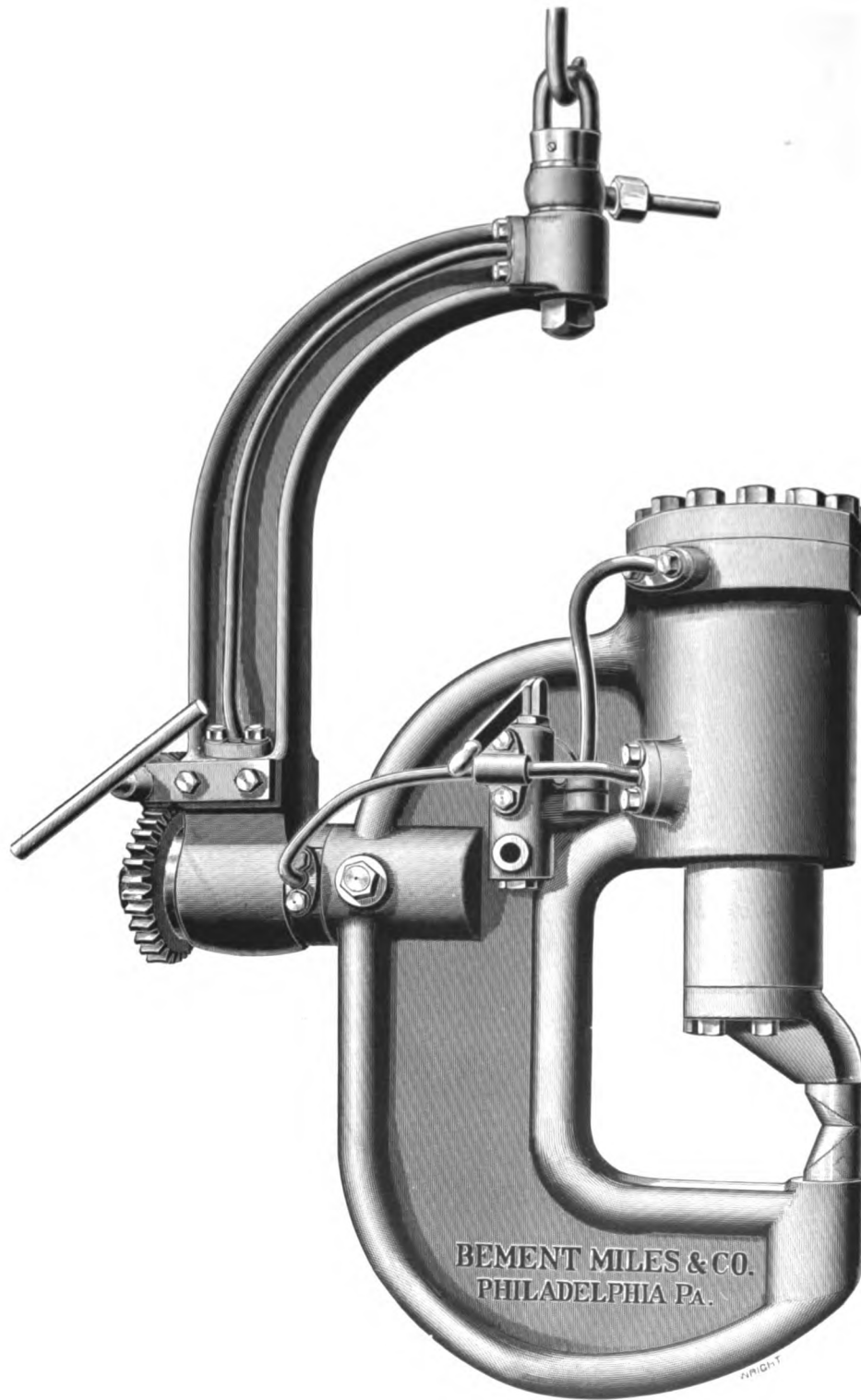
Can be built for any pressure from 50 to 150 tons, with or without a plate closing attachment. Distance from centre of die to bottom of opening, 124 inches. Cylinder and ram are both of steel, with flat upper surfaces, allowing flanged plates of any dimensions to be riveted in any position. Riveting ram is of rectangular section, permitting the use of offset dies when required. Valves are simple in construction, and are operated by a single movement of a hand lever. Stroke is adjustable in length, economizing water when the full length of movement is not required. Stake is of wrought iron (or steel), held to frame by large bolts, and can be arranged to receive a supplementary stake for riveting small flues, if desired.

The illustration on the opposite page represents a riveter with a supplementary stake of steel. These are usually made with a gap of from 36 to 60 inches, as required.



204-INCH HYDRAULIC RIVETING MACHINE, WITH STEEL FRAMES.

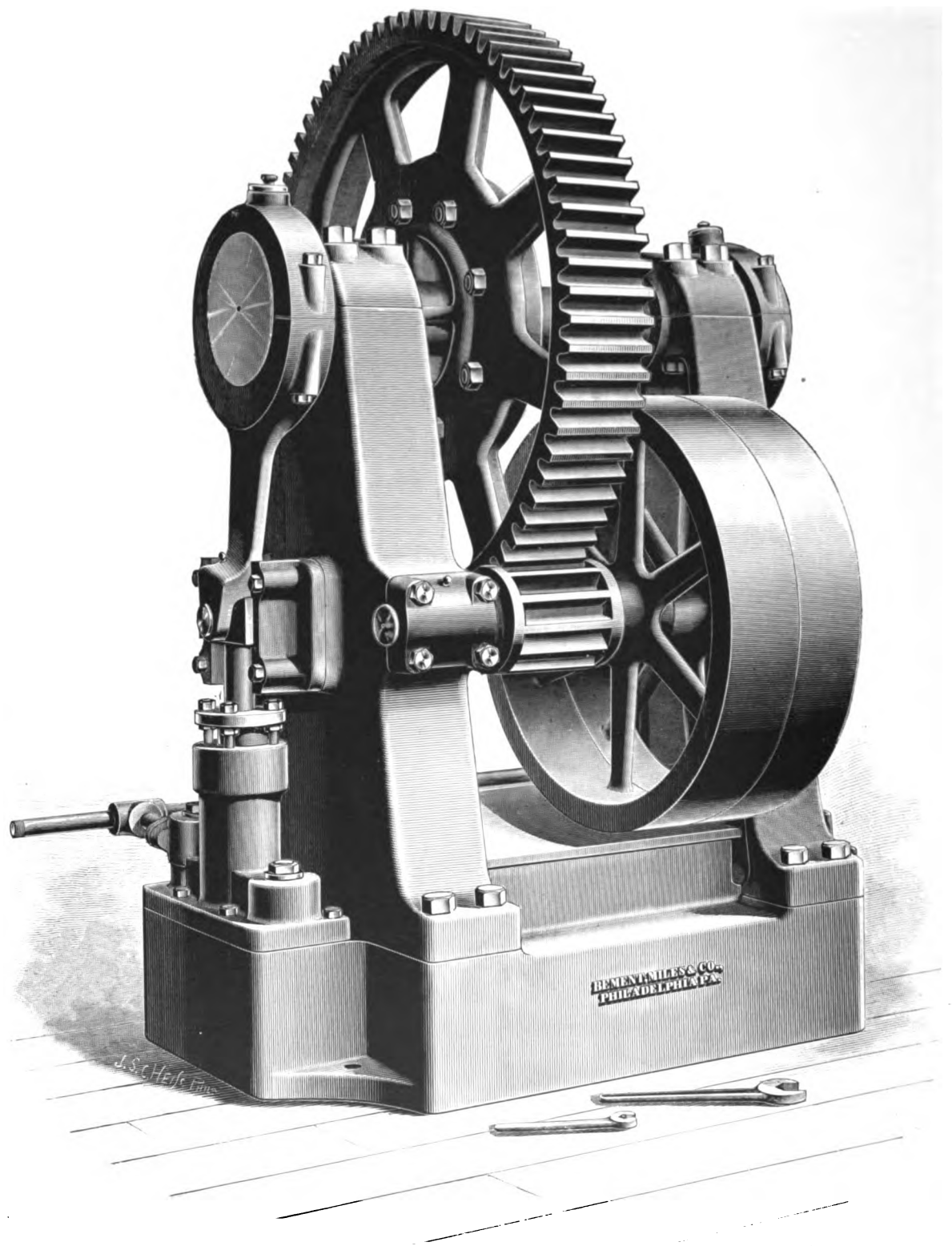
Our hydraulic riveters larger than the 10-foot size, are preferably built with gaps of 12 feet, 14 feet and 17 feet, though intermediate sizes will be furnished, if required. The illustration shows a 17-foot machine with steel framing and cylinder, capable of exerting a pressure of $33\frac{1}{3}$, $66\frac{2}{3}$ and 100 tons, without any change in the accumulator weights. The riveters previously noticed can also be arranged with three different pressures by a special construction of the cylinder.



75-TON PORTABLE HYDRAULIC RIVETING MACHINE.

PORTABLE HYDRAULIC RIVETING MACHINES.

These machines are built for pressures of 25 tons to 100 tons, as may be required, and with depths of gap from $2\frac{1}{2}$ inches to 60 inches. All the main castings are made of steel. The illustration shows a riveter with a gap of 12 inches.



No. 3 DOUBLE HYDRAULIC PRESSURE PUMP.

No. 2 HYDRAULIC PRESSURE PUMP.

Driven by a large and wide-faced pulley, having sufficient power to work against any required pressure without gearing. Has two single-acting brass pumps, the plungers of which are protected from lateral wear by guides.

No. 3 HYDRAULIC PRESSURE PUMP.

Consists of two single-acting pumps, operated by pulleys and gearing, and calculated for thirty gallons of water per minute. The pump plungers are guided, and all bearings are provided with caps, or are otherwise arranged to take up wear. Water tank is contained in the base of the machine.



HYDRAULIC ACCUMULATOR, 3 TO 6-INCH RAM.

HYDRAULIC ACCUMULATORS.

The style of accumulator shown by the illustration is best adapted for small sizes. It is self-supporting, and may have as many weights as there are variations in the required power. These weights may be used together, or one or more, may be detached when a lighter pressure is required. The upper one is fixed to the ram, and the others are quickly applied, or detached by bolts inserted in recesses in the periphery. Packings are easy of access, and readily renewed. Packing mould and wrenches included. We build the above of the following sizes, viz :

With 3-inch ram, 36-inch stroke.

With 5-inch ram, 60-inch stroke.

With 5-inch ram, 72-inch stroke.

With 6-inch ram, 60-inch stroke.

With 6-inch ram, 72-inch stroke.

Purchasers may, if they desire, order the accumulator with only the upper weight, or exclusive of any of them.



HYDRAULIC ACCUMULATOR, 10-INCH RAM.

HYDRAULIC ACCUMULATORS.

Constructed with a platform supporting a wrought-iron tank for holding the weight, usually consisting of scrap iron. They can be furnished with the tank, or with the platform only. All are guided as shown by illustration. We build these accumulators of the following sizes, viz :

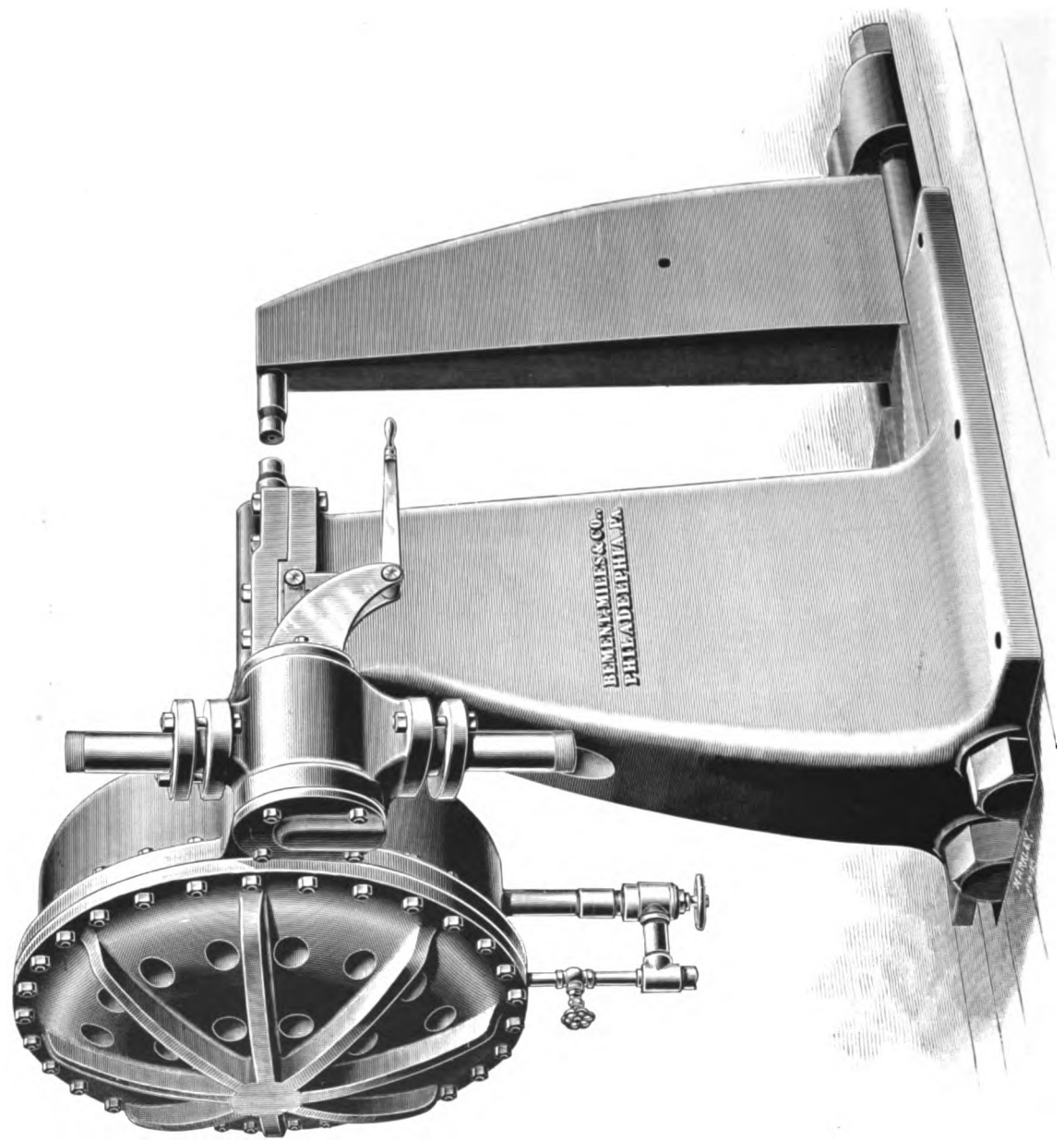
- With 6-inch ram, 6-foot stroke.
- With 8-inch ram, 8-foot stroke.
- With 8-inch ram, 9-foot stroke.
- With 8-inch ram, 10-foot stroke.
- With 10-inch ram, 10-foot stroke.
- With 10-inch ram, 12-foot stroke.
- With 10-inch ram, 15-foot stroke.
- With 12-inch ram, 12-foot stroke.
- With 12-inch ram, 14-foot stroke.
- With 12-inch ram, 16-foot stroke.
- With 14-inch ram, 14-foot stroke.
- With 14-inch ram, 16-foot stroke.
- With 14-inch ram, 18-foot stroke.

HYDRAULIC CRANES.

We build riveter cranes of various capacities, height of lift and length of traverse of bridge and trolley. The following are the sizes thus far furnished by us, viz :

- To lift 7 tons, with radial jib.
- To lift 7 tons, with right angled movement.
- To lift 10 tons, with radial jib.
- To lift 10 tons, with right angled movement.
- To lift 15 tons, with radial jib.
- To lift 15 tons, with right angled movement.
- To lift 25 tons, with radial jib.
- To lift 25 tons, with right angled movement.
- To lift 40 tons, with radial jib.
- To lift 40 tons, with right angled movement.

Propositions do not include the structure upon which the cranes are supported, nor the rails upon which the wheels revolve.



96-INCH STEAM RIVETING MACHINE, WITH 43-INCH CYLINDER.

72-INCH STEAM RIVETING MACHINE.

Cylinder is made 32 inches, 36 inches and 43 inches in diameter, depending upon the pressure required. Distance from centre of die to bottom of opening, 74 inches. Stake is made of wrought iron, or cast steel, as preferred, and is firmly screwed to frame by large bolts. Piston rod is of steel, so arranged that it will not turn, by which means riveting may be done with offset dies, when required. Self-adjusting metallic packing for piston rod. Valve is perfectly balanced, and capable of driving rivets by either a pressure or blow, as may be preferred. The steam used in working also returns the piston before escaping.

96-INCH STEAM RIVETING MACHINE.

Cylinder is usually made 36 inches, or 43 inches in diameter, depending upon the pressure required. Distance from centre of die to bottom of opening, 98 inches. Stake is made of wrought iron, or cast steel, as preferred, and is firmly screwed to frame by large bolts. Piston rod is of steel, so arranged that it will not turn, by which means riveting may be done with offset dies when required. Self-adjusting metallic packing for piston rod. Valve is perfectly balanced, and capable of driving rivets by either a pressure, or blow, as may be preferred. The steam used in working also returns the piston before escaping.

120-INCH STEAM RIVETING MACHINE.

Cylinder is usually made 36 inches, or 43 inches in diameter, depending upon the pressure required. Distance from centre of die to bottom of opening, 124 inches. Stake is made of wrought iron, or cast steel, as preferred, and is firmly screwed to frame by large bolts. Piston rod is of steel, so arranged that it will not turn, by which means riveting may be done with offset dies when required. Self-adjusting metallic packing for piston rod. Valve is perfectly balanced, and capable of driving rivets by either a pressure, or blow, as may be preferred. The steam used in working also returns the piston before escape.

For steam riveting machines, we build power, or hand, cranes of any required size.

Steam Hammers for Iron
and Steel,
Steam Drop Hammers.

STEAM HAMMERS.

GENERAL REMARKS.

In designating or describing a steam hammer, it is rated by the falling weight of the piston, ram and ram die; thus a 1000-pound hammer means one whose piston, ram and die together weigh 1000 pounds. This takes no account of the top steam used, which enormously multiplies the force of the blow, nor of the force acquired by gravity in the descent of the falling parts. The rating of a hammer, by the weight of the connected falling parts, is simple and easily understood, while any statement as to the force of the blow is difficult of expression and has no practical value. In general design and arrangement, even to the smallest details, our hammer is as simple as it can be made, and the whole construction is illustrative of a complete adaptation to its purpose. The valve gear, arranged with the least possible number of moving pieces, takes up its own lost motion by gravity, hence it will control a hammer with great uniformity for a much longer time than would otherwise be possible. Having no connection with the ram, it escapes all concussion. It is so designed as to produce, automatically or by hand, every variation in the length, position and force of the blow by a single lever with no extra gear. The patented adjustable guides, for taking up the wear of the ram, are an important addition, the value of which has been well demonstrated by the fact that nearly all our hammers are now provided with them. Anvils are usually made with a removable cap of iron, or steel, to admit of repair, or replacement, without the necessity of removing the whole anvil.

SINGLE FRAME STEAM HAMMERS.

FOR GENERAL WORK.

WITH AND WITHOUT ADJUSTABLE GUIDES.

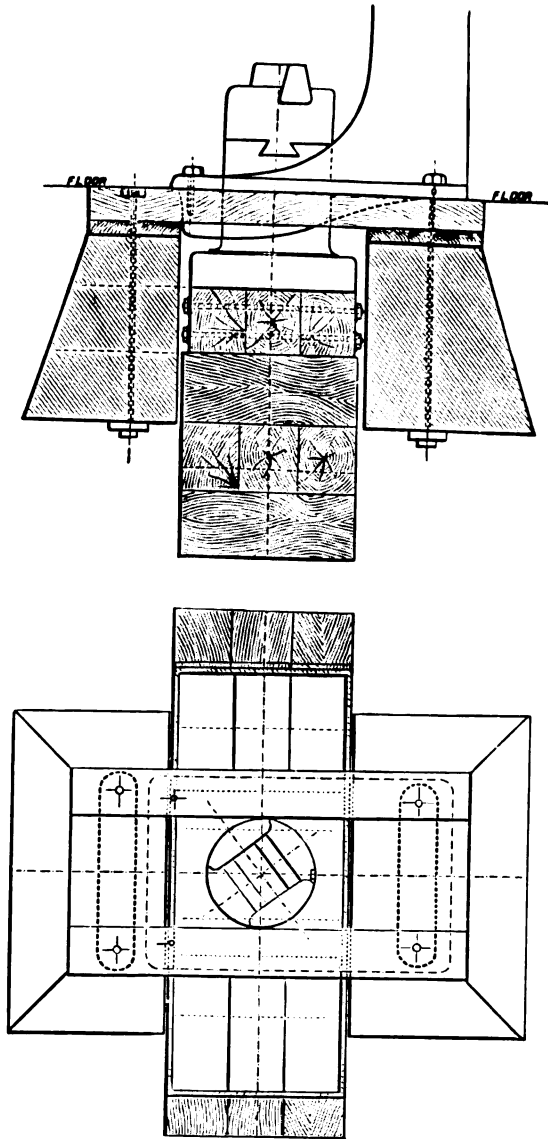
With detached anvils, valves perfectly balanced, and valve gear simple and substantial, producing, automatically or by hand, every desired variation in the length, position and force of blow. Double-acting, taking steam above and below piston, which is so arranged that it can be raised above top of cylinder to examine packing rings, or insert new ones, without disconnecting. Steel spiral springs are used for safety buffers, to prevent damage from careless handling. The ram and guides are set diagonally to the frames, so that the work may be handled lengthwise, or across the dies.

Every hammer is tried with steam before leaving our works.

SIZE OF HAMMER (FALLING WEIGHT).	LENGTH OF STROKE.	FACE OF RAM OR RAM DIE.
200 pounds.	13 inches.	5 x 7 $\frac{3}{4}$ inches.
250 "	16 "	5 x 7 $\frac{1}{4}$ "
300 "	16 "	5 $\frac{1}{2}$ x 9 "
350 "	18 "	6 x 8 $\frac{1}{2}$ "
500 "	20 "	6 $\frac{1}{2}$ x 10 $\frac{1}{2}$ "
600 "	22 "	6 $\frac{3}{4}$ x 10 $\frac{1}{2}$ "
700 "	22 "	7 $\frac{1}{4}$ x 12 $\frac{1}{4}$ "
800 "	22 "	7 $\frac{1}{4}$ x 12 $\frac{1}{4}$ "
1,100 "	28 "	8 $\frac{1}{4}$ x 13 "
1,500 "	30 "	9 x 16 "
2,000 "	33 "	9 $\frac{1}{2}$ x 16 $\frac{1}{2}$ "
2,500 "	36 "	10 $\frac{1}{2}$ x 17 $\frac{1}{4}$ "
4,000 "	42 "	12 x 20 "

The face of the ram only determines the size of the dies one way, *i. e.*, between the guides; the other way they can be made to suit the needs of the purchaser. The hammers can be fitted when required, with a patent treadle, by which the operator can work the valve gear with his foot. The ram can be started upward off the anvil, or made to hang suspended and start with a downward blow. All of the single standard hammers have adjustable guides, except the 200-pound, 300-pound, 500-pound and 700-pound sizes.

Complete foundation drawings, suited to any locality, furnished upon receipt of order.



THE FOUNDATIONS.

Are simple and inexpensive. They consist of one long pier for the anvil seat, and two smaller ones to support the bed plate. The cut on the opposite page illustrates the arrangement. The anvil rests upon a separate foundation pier, in order to reduce the effect of concussion upon the frame. This pier is made long, extending beyond the hammer on each side, to provide abundant area for its support; and the ends are left open for convenient access, in case the anvil should settle and require readjustment.

In marshy places the piers should rest on piles or on timber platforms, and the anvil should be raised 2 or 3 inches higher than our drawing, to allow for settlement. A warning mark V, on the guides, shows when the piston touches the bottom of the cylinder. Before this mark is reached, the anvil must be raised, or a higher anvil die used.

We furnish with each hammer a drawing of the foundation, indicating its proper dimensions and depth, also position and size of bolts, anvil, etc.



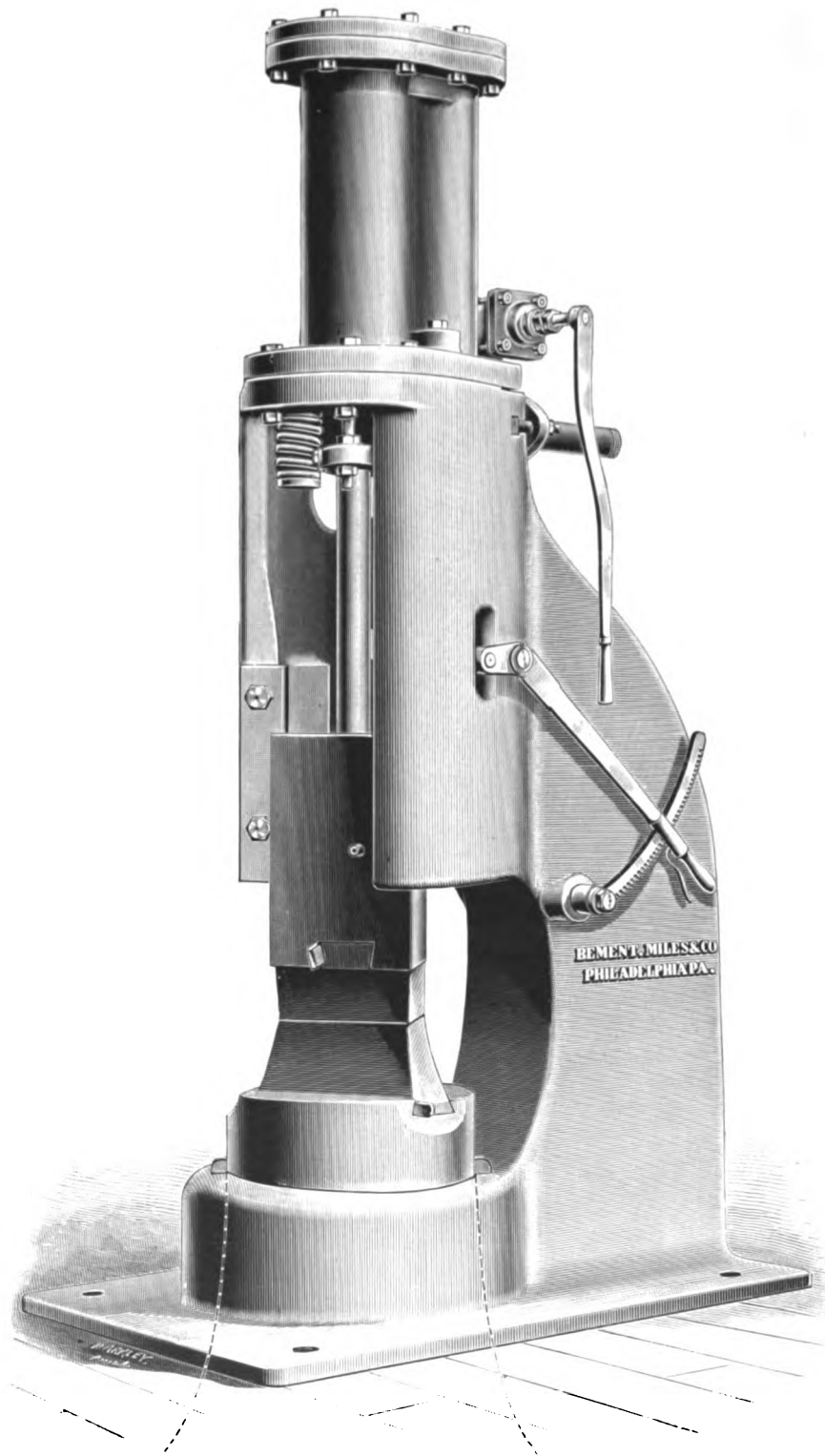
600-POUND STEAM HAMMER.

600-POUND STEAM HAMMER—SINGLE STANDARD,

WITH ADJUSTABLE GUIDES.

Weight of drop and attached parts, 600 pounds. Takes steam above and below piston; has an extreme stroke of 22 inches, and greatest upper die surface of $10\frac{1}{2}$ inches by $6\frac{3}{4}$ inches. Ram and guides are set diagonally to the frame at the proper angle for drawing and finishing. Valve is perfectly balanced, easily handled and of great durability; valve gear is simple and substantial, takes up its own lost motion, and operates either automatically or by hand, producing every desired variation in length, position, rapidity and force of blow. If required, a treadle can be applied, by which the workman can operate the hammer without assistance when forging short pieces. Piston can be raised above top of cylinder for insertion of the rings without separating rod from drop. Anvil is made with a separate cap which can be renewed without disturbing the hammer. To facilitate its removal, the frame is curved downward to the base plate, and ribs are extended below the floor line to maintain its rigidity. Every hammer tried before leaving the works. Foundation drawings furnished free of charge.

The above description applies equally well to the 250-pound, 350-pound, 800-pound and 1100-pound steam hammers; reference being made to the tabulated statement on another page for length of stroke and die surface.

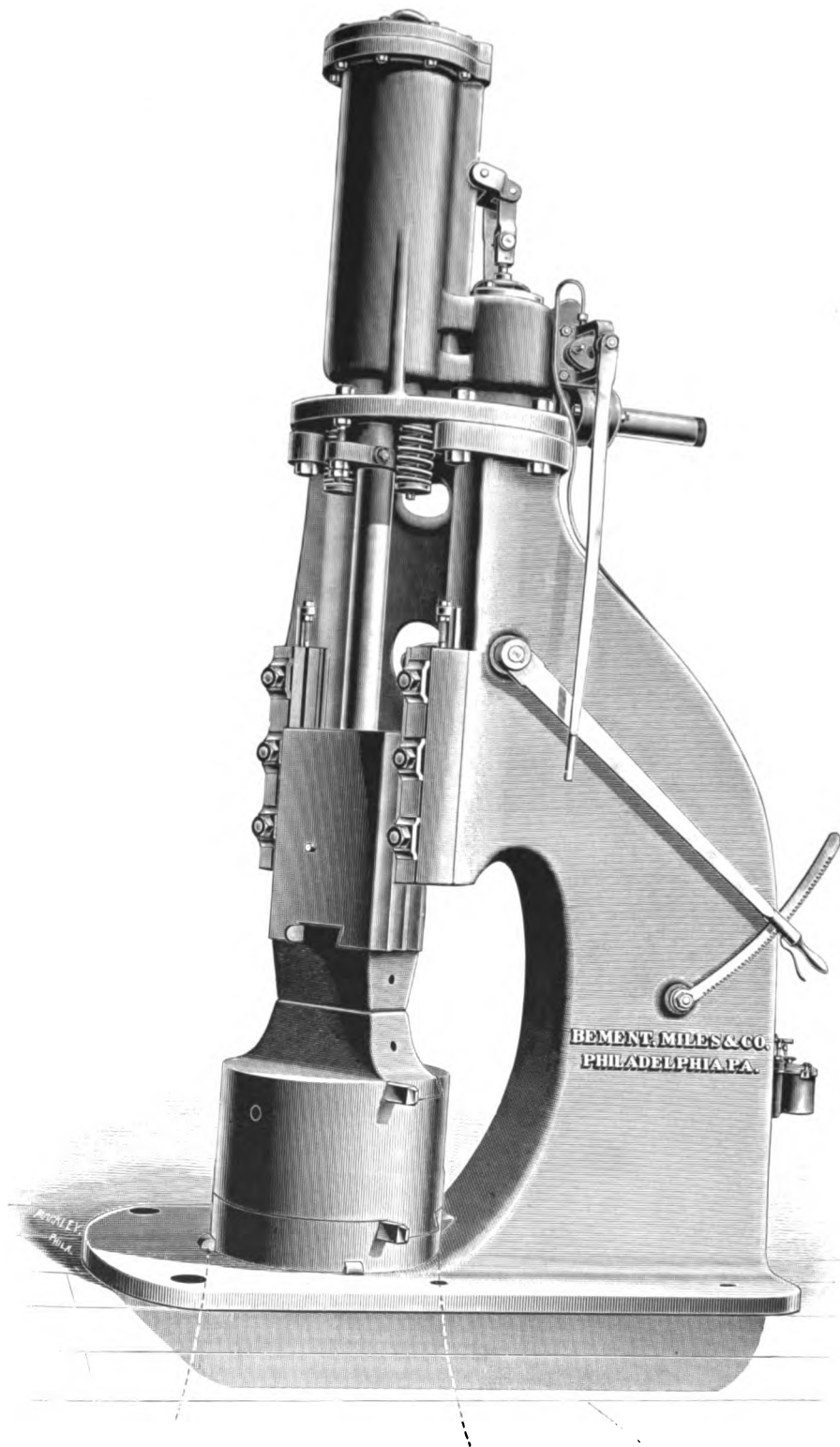


700-POUND STEAM HAMMER.

700-POUND STEAM HAMMER—SINGLE STANDARD.

Weight of drop and attached parts, 700 pounds. Takes steam above and below piston; has an extreme stroke of 22 inches, and upper die surface of $12\frac{1}{4}$ inches by $7\frac{1}{4}$ inches. Ram and guides are set diagonally to the frame at the proper angle for drawing and finishing. Valve is perfectly balanced, easily handled and of great durability; valve gear is simple and substantial, takes up its own lost motion, and operates either automatically or by hand, producing every desired variation in the length, position, rapidity and force of blow. If required, a treadle can be applied, by which the workman can operate the hammer without assistance when forging short pieces. Piston can be raised above top of cylinder for insertion of the rings without separating rod from drop. Every hammer tried before leaving the works. Foundation drawings furnished free of charge.

The above description applies equally well to the 200-pound, 300-pound and 500-pound steam hammers; reference being made to the tabulated statement on another page, for length of stroke and die surface.



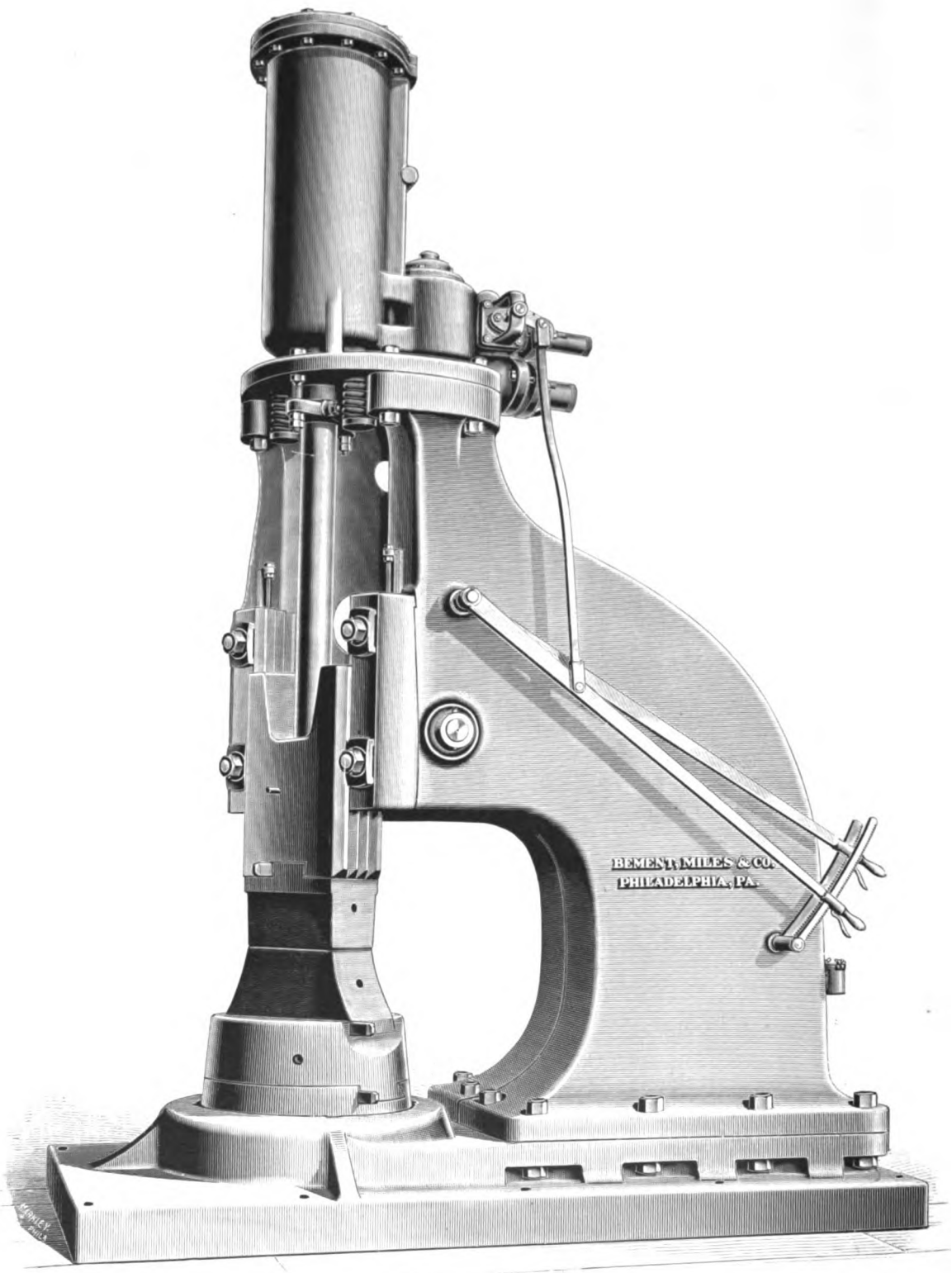
1500-POUND STEAM HAMMER.

1500-POUND STEAM HAMMER—SINGLE STANDARD,

WITH ADJUSTABLE GUIDES.

Weight of drop and attached parts, 1500 pounds. Takes steam above and below piston; has an extreme stroke of 30 inches and greatest upper die surface of 16 inches by 9 inches. Ram and guides are set diagonally to the frame at the proper angle for drawing and finishing. Valve is perfectly balanced, easily handled and of great durability; valve gear is simple and substantial, takes up its own lost motion, and operates either automatically or by hand, producing every desired variation in the length, position, rapidity and force of blow. Piston can be raised above top of cylinder for insertion of rings without separate rod from drop. Anvil is made with separate cap which can be renewed without disturbing the hammer. To facilitate its removal the frame is curved downward to the base plate and ribs are extended below the floor line to maintain its rigidity. Every hammer tried before leaving the works. Foundation drawings furnished free of charge.

The above description applies equally well to the 2000-pound and 2500-pound sizes; reference being made to the tabulated statement on a preceding page for length of stroke and die surface.



4000-POUND STEAM HAMMER.

4000-POUND STEAM HAMMER—SINGLE STANDARD,

WITH ADJUSTABLE GUIDES.

Weight of drop and attached parts, 4000 pounds. Takes steam above and below piston, has an extreme stroke of 42 inches and upper die surface of 20 inches by 12 inches. Distance from inside of frame to centre of die, 48 inches. Ram and guides are set diagonally to the frame at the proper angle for drawing and finishing. Valve is perfectly balanced, easily handled and of great durability; valve gear is simple and substantial, takes up its own lost motion and operates either automatically or by hand, producing every desired variation in length, position, rapidity and force of blow. Piston can be raised above top of cylinder for insertion of the rings without separating rod from drop. Anvil is made with a separate cap which can be renewed without disturbing the hammer. The base plate for this hammer is separate and measures 12 feet by 6 feet. Every hammer is tried before shipment. Foundation plans furnished free of charge.

DOUBLE FRAME STEAM HAMMERS.

FOR GENERAL WORK.

WITH AND WITHOUT ADJUSTABLE GUIDES.

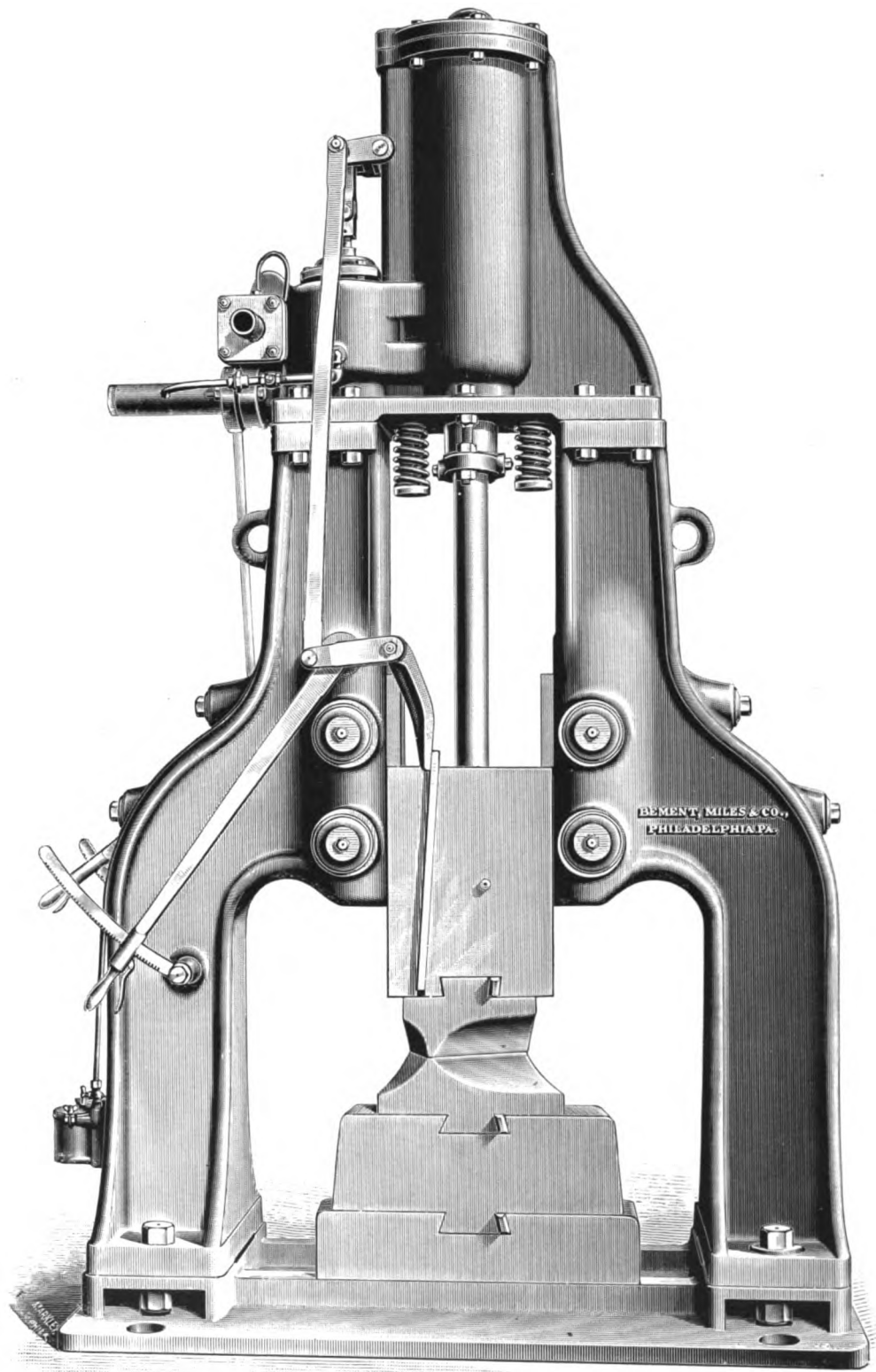
These also have detached anvils, valve and gear similar to those of the single frame hammers. All are double-acting, taking steam above and below piston, which is so arranged that it can be raised above top of cylinder to examine packing rings, or insert new ones without disconnecting. Steel spiral springs are used for safety buffers to prevent damage from careless handling. The steam and exhaust connections have stuffing box joints and are placed at the side, leaving all possible allowance for cranes.

Every hammer is tried with steam before leaving our works.

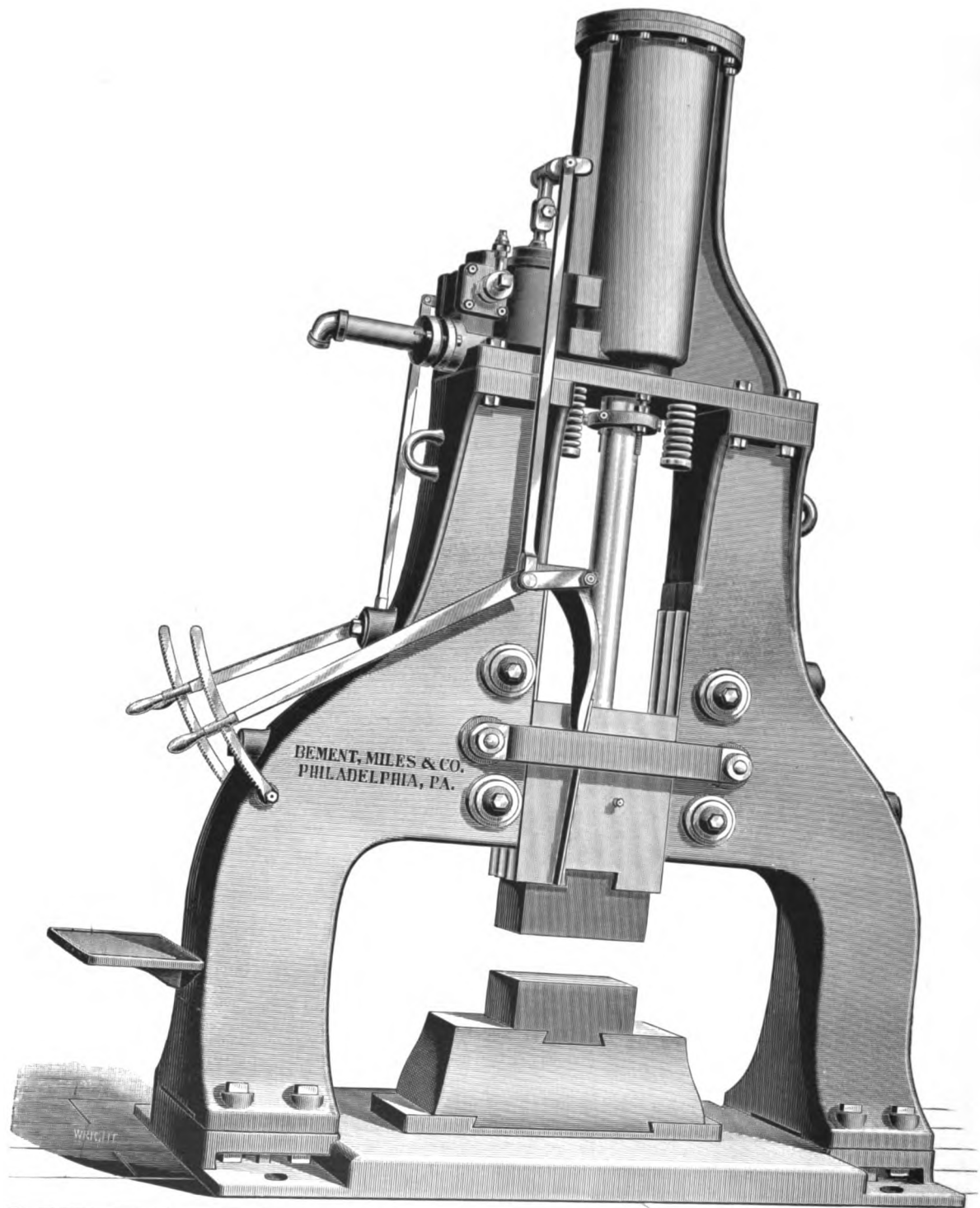
SIZE OF HAMMER (FALLING WEIGHT).	USUAL LENGTH OF STROKE.	USUAL FACE OF RAM OR RAM DIE.
1,500 pounds.	30 inches.	9 x 16 inches.
2,000 "	36 "	9½ x 17¼ "
2,500 "	36 "	10 x 18½ "
3,000 "	42 "	10 x 20½ "
3,500 "	48 "	11 x 20½ "
4,000 "	48 "	12 x 22 "
4,500 "	48 "	13 x 22 "
5,000 "	54 "	13 x 22 "
6,000 "	60 "	14 x 22 "
8,000 "	60 "	17 x 26 "
10,000 "	72 "	17 x 28 "
12,000 "	72 "	18 x 28 "
15,000 "	84 "	18 x 36 "
20,000 "	96 "	18 x 38 "
30,000 "	108 "	29½ x 38 "
40,000 "	120 "	30 x 42 "

All of the hammers up to 12,000 pounds have adjustable guides, and the larger sizes will be provided with them, if ordered. Most of those above 12,000 pounds have divided uprights, giving four supports.

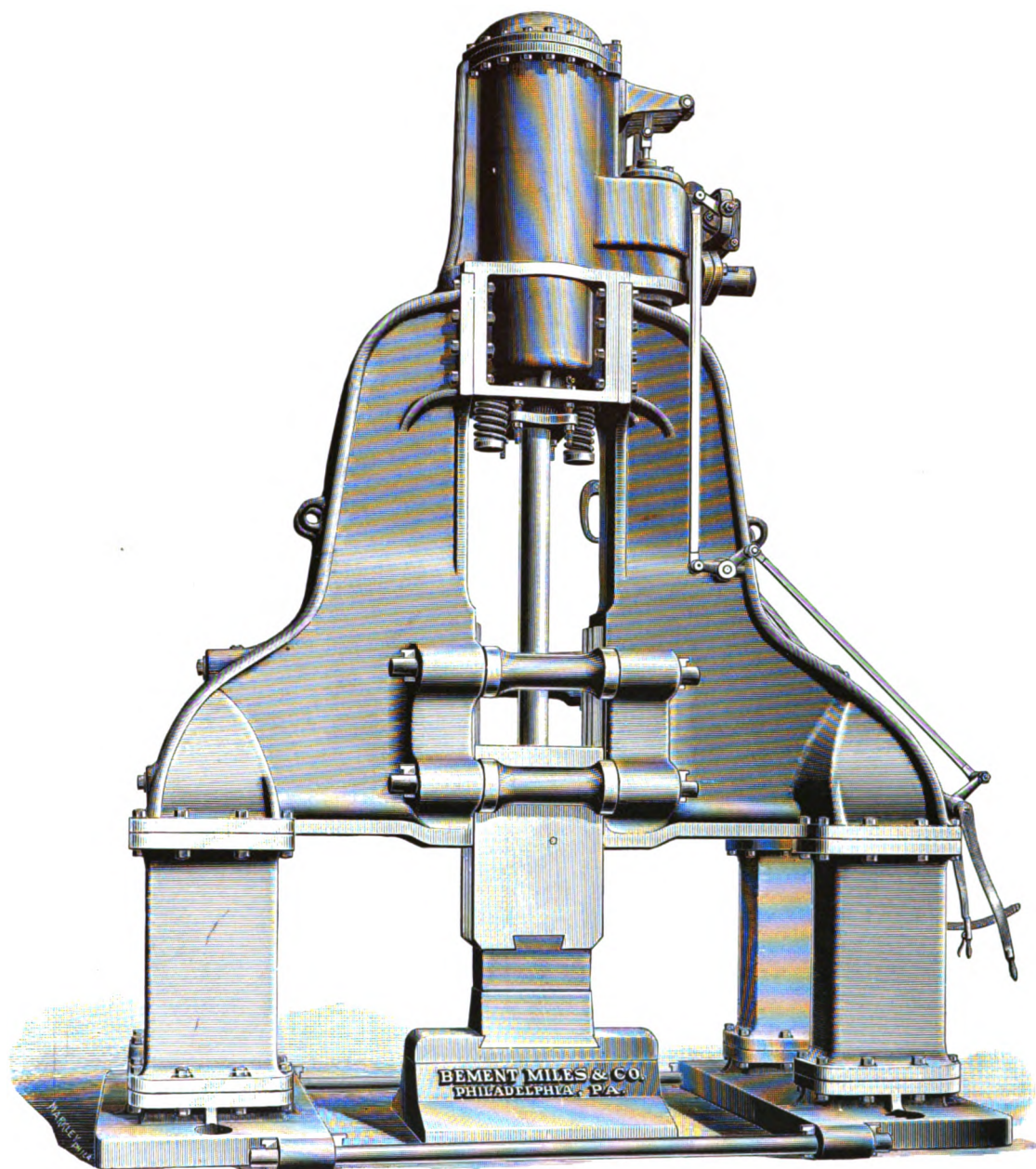
Complete foundation drawings, suited to any locality, furnished upon receipt of order.



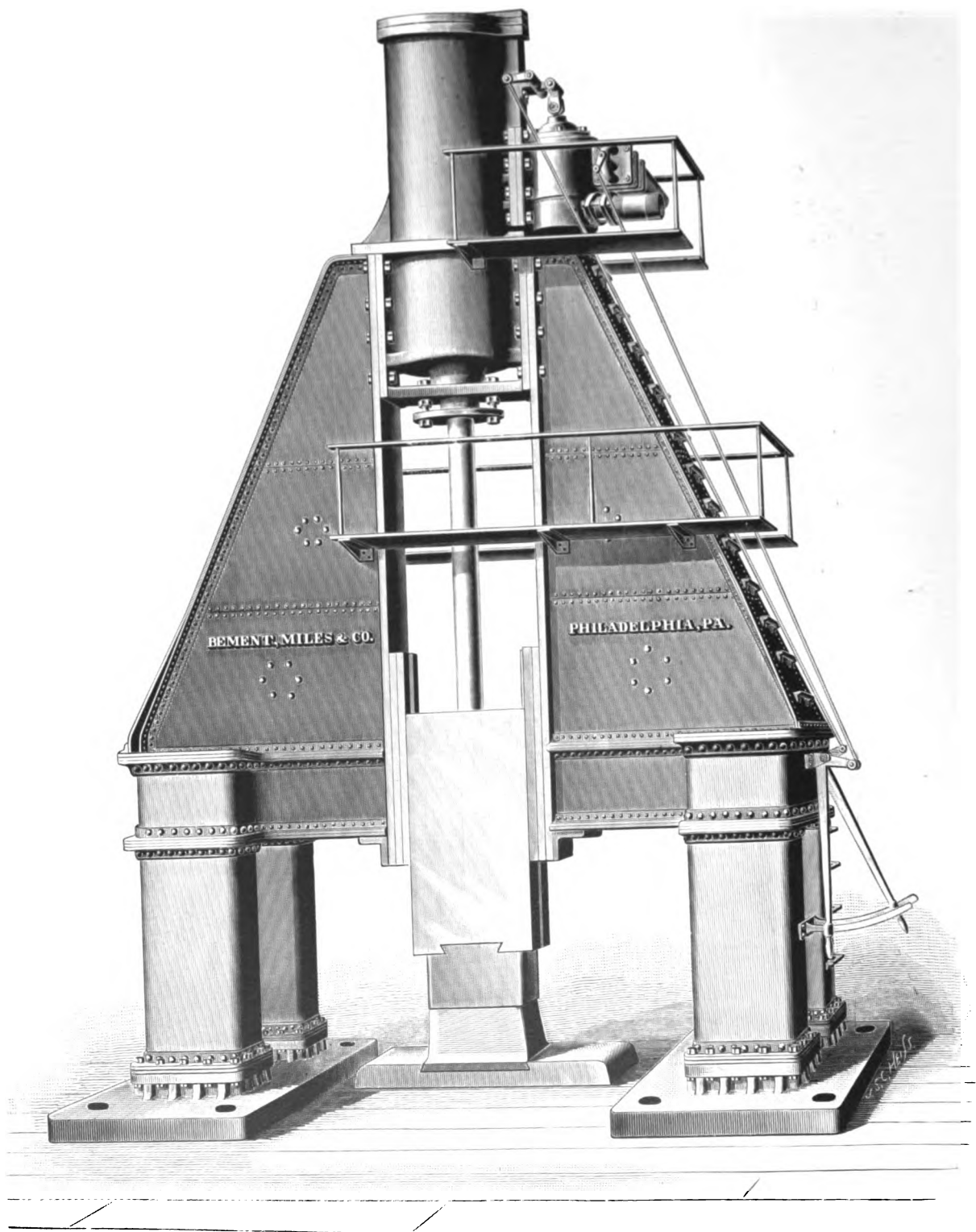
1500-POUND DOUBLE FRAME STEAM HAMMER.



4500-POUND DOUBLE FRAME STEAM HAMMER.



12,000-POUND STEAM HAMMER, WITH DIVIDED UPRIGHTS.

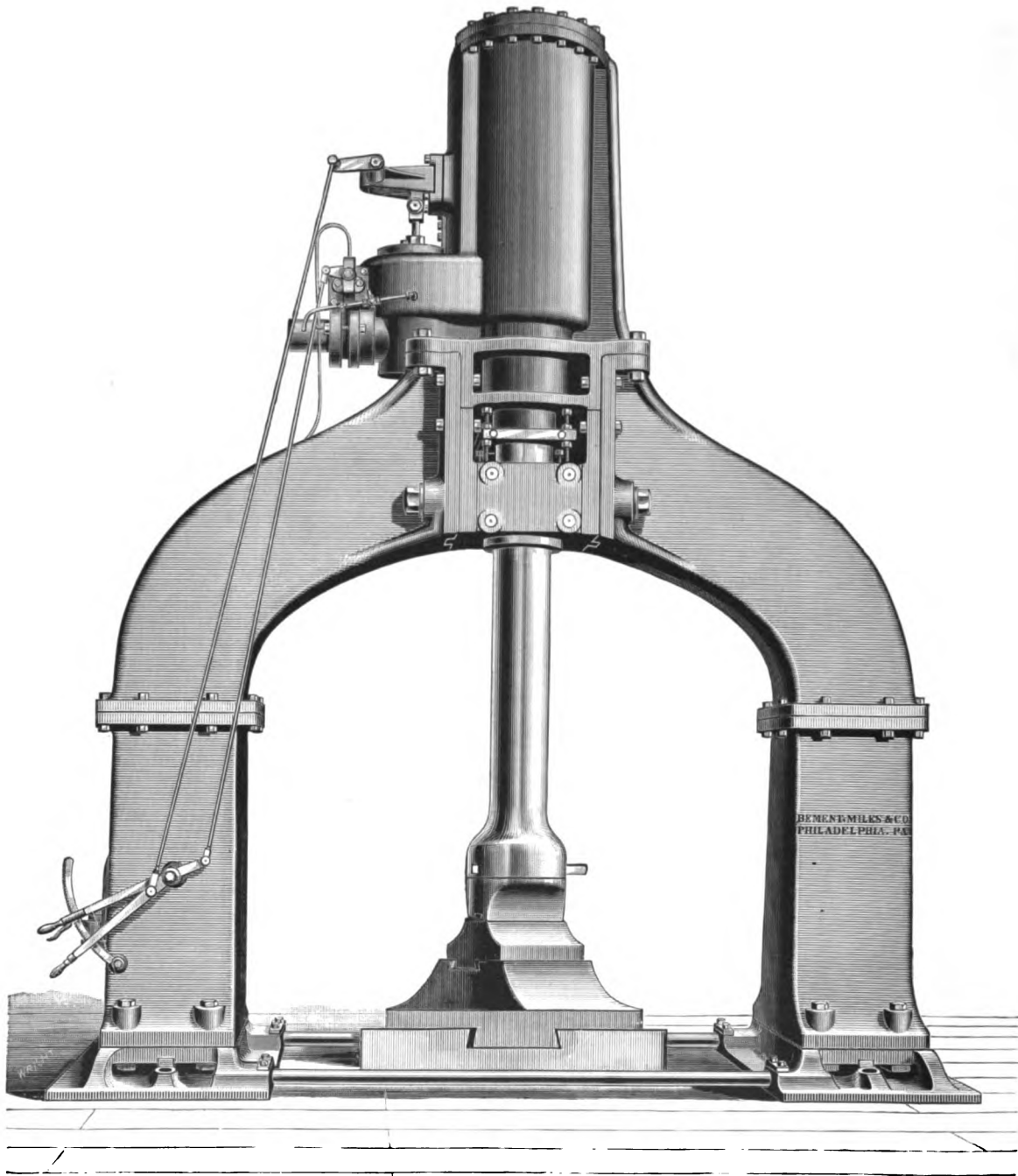


30,000-POUND STEAM HAMMER, WITH WROUGHT IRON FRAMING.

STEAM HAMMERS, WITH DOUBLE STANDARDS.

With or without adjustable guides, as required; and of the following sizes, viz : 500 pounds, 700 pounds, 1000 pounds, 1500 pounds, 2000 pounds, 2500 pounds, 3000 pounds, 3500 pounds, 4000 pounds, 4500 pounds, 5000 pounds, 6000 pounds, 8000 pounds, 10,000 pounds, 12,000 pounds, 15,000 pounds, 20,000 pounds, 30,000 pounds and 40,000 pounds. Any of these sizes can be specially arranged for steel or iron work. Each has a balanced valve, and is double-acting, the valve gear being simple and substantial, taking up its own lost motion as it wears, and producing every desired variety of blow. Very large hammers are not built to work automatically, except when so ordered; these may have divided uprights, affording working space both at the front and sides. Detailed propositions, with or without anvils and dies, furnished upon application.

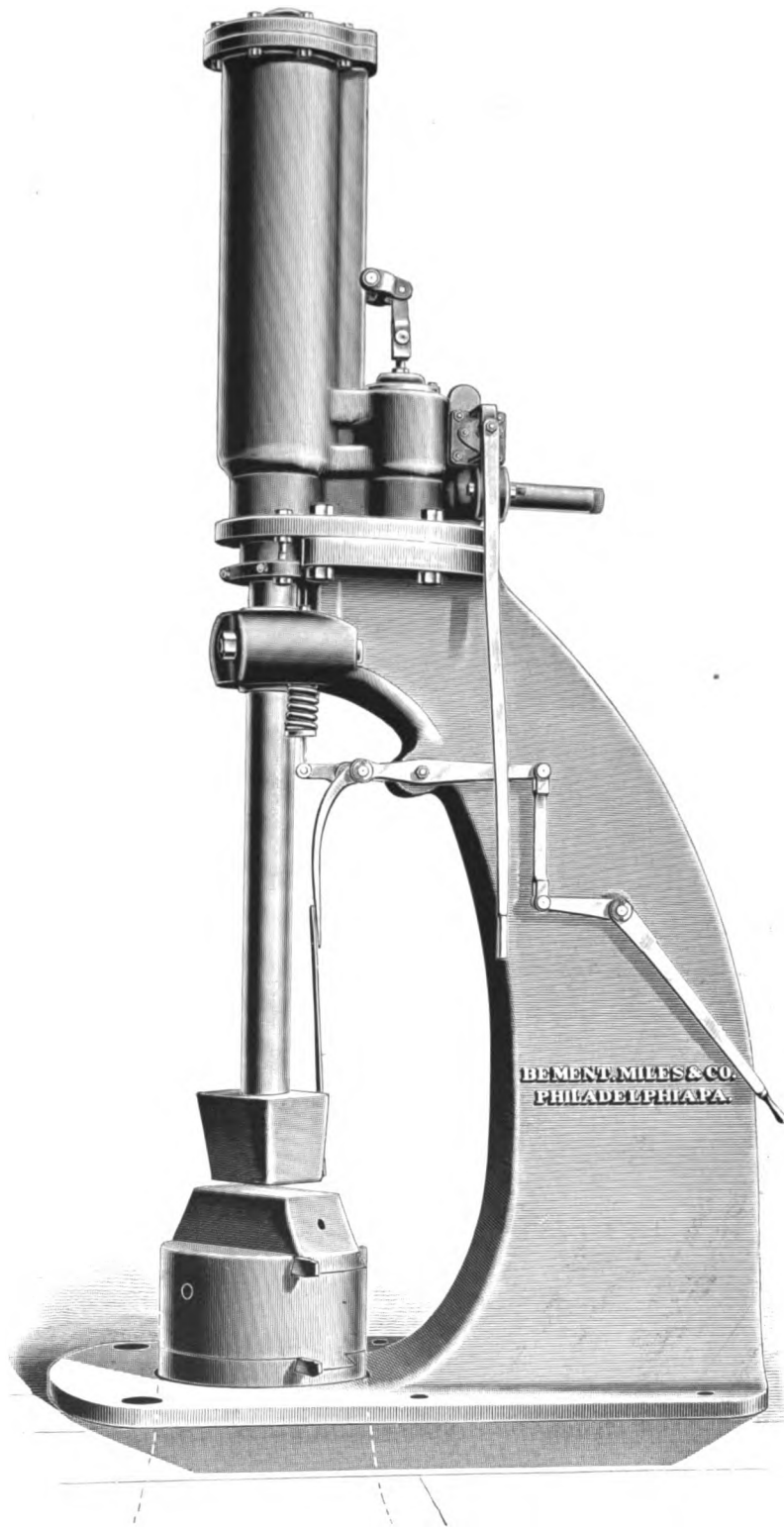
When required, estimates will be made for hammers having a falling weight of 50,000 pounds to 100,000 pounds.



6000-POUND OPEN FRAME STEAM HAMMER.

OPEN FRAME STEAM HAMMERS.

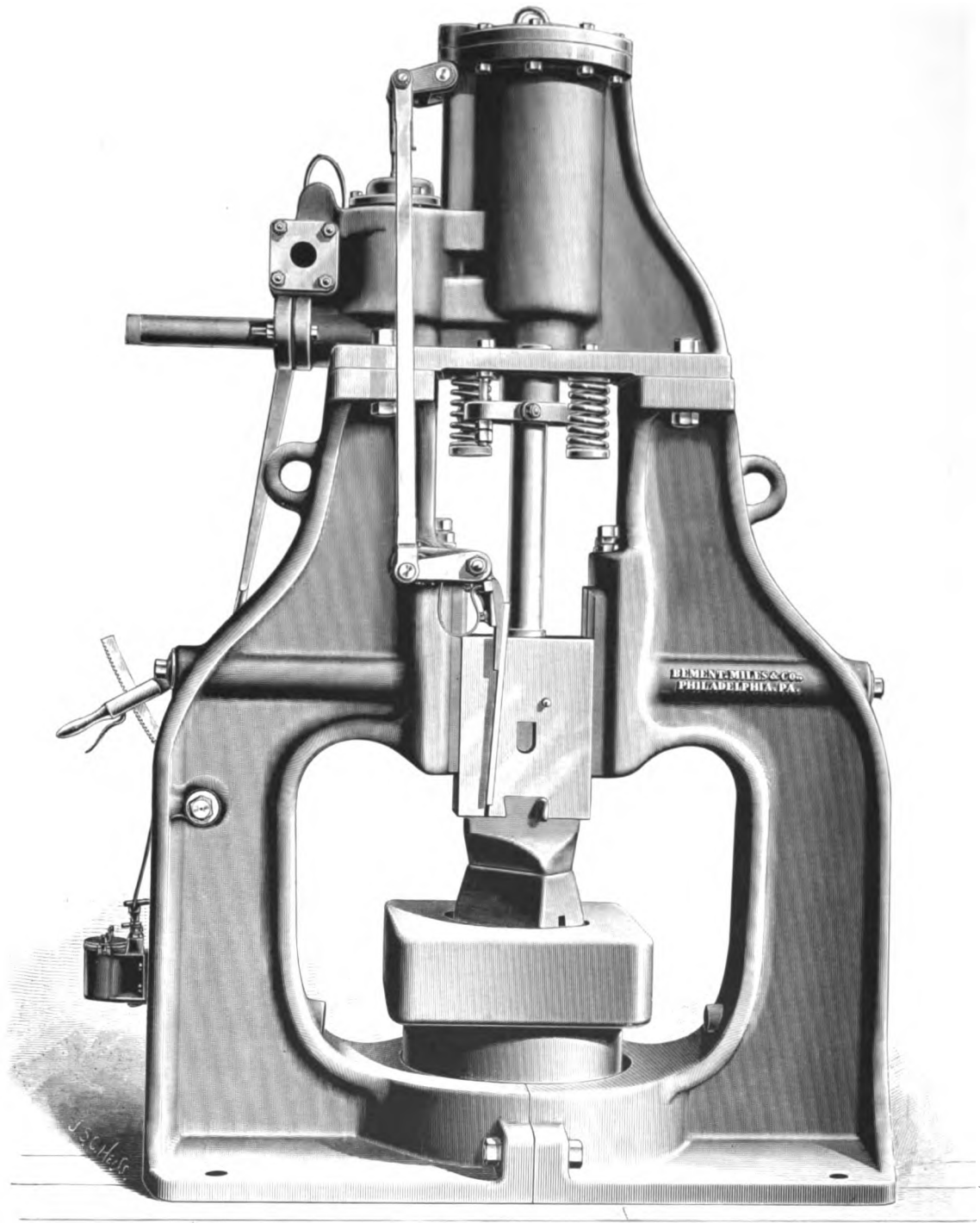
With widely separated standards for work requiring an extra space for handling. These hammers are built of the following sizes, viz : 4000 pounds, with 42-inch stroke ; 6000 pounds, with 48-inch stroke ; 10,000 pounds, with 60-inch stroke ; 15,000 pounds, with 72-inch stroke, and 20,000 pounds, with 84-inch stroke. All have adjustable guides placed below the cylinder. The valve is balanced and hand operating, unless otherwise ordered, the valve gear being very simple and substantial. The largest sizes may be built with divided uprights, affording working space both at the front and sides.



LOCOMOTIVE PEDESTAL STEAM HAMMER.

LOCOMOTIVE PEDESTAL STEAM HAMMER.

Falling weight, 1600 pounds. With an extra long stroke of 45 inches, and adjustable guides for taking up the wear, placed close under the cylinder, leaving a space below equal to the whole stroke; for forging irregular shapes, such as cranks, marine rudders, etc., and particularly for welding pedestal jaws on locomotive frames. Takes steam above and below piston; valve is perfectly balanced, valve gear takes up its own lost motion and operates automatically or by hand, giving every desired variety of blow. Anvil is detached and has a removable cap.



500-POUND STEEL WORKING HAMMER.

DOUBLE FRAME STEAM HAMMERS,

SPECIALLY ADAPTED FOR WORKING STEEL.

WITH PATENT ADJUSTABLE GUIDES.

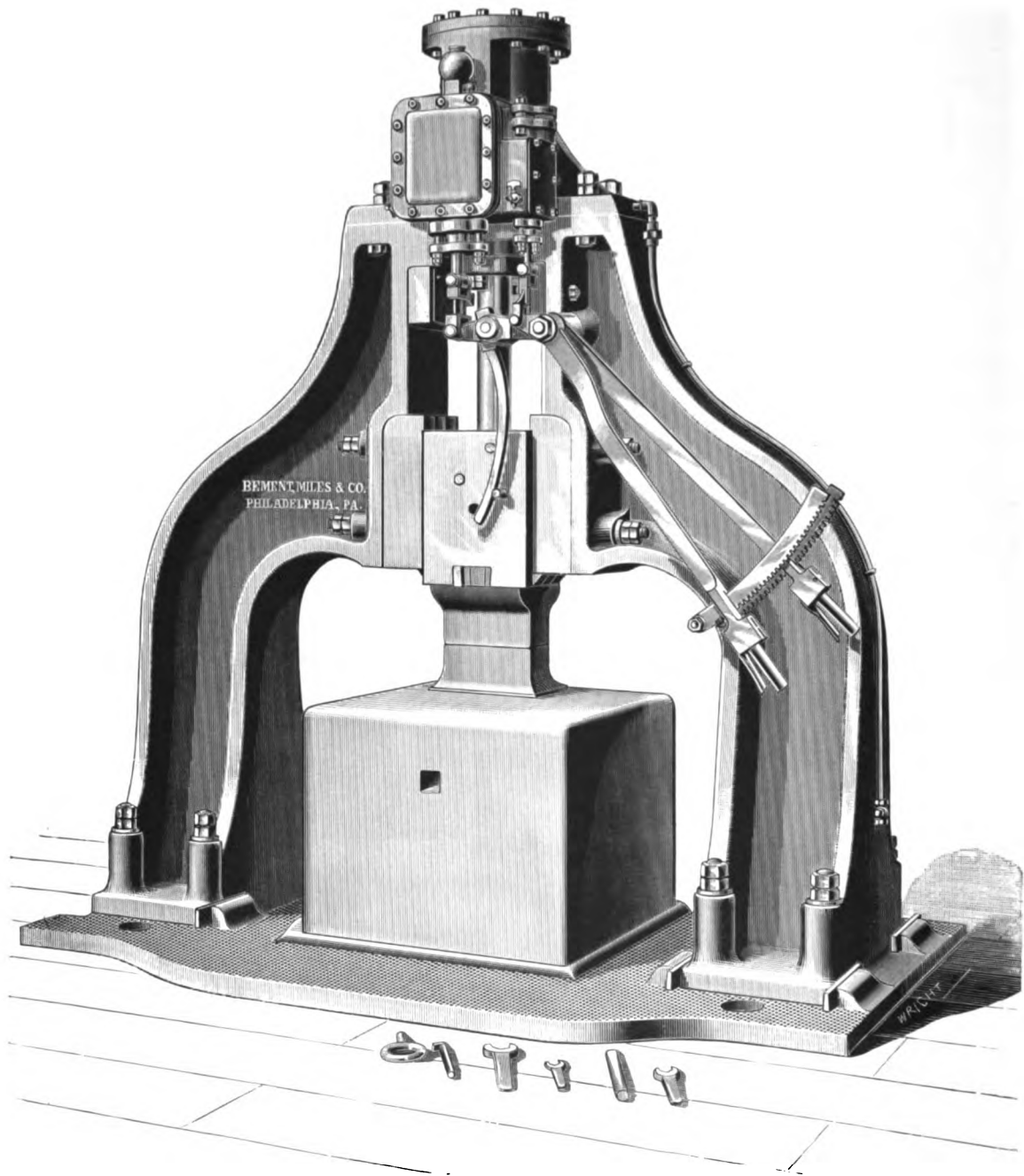
These have detached anvils, and valve gear similar to the other hammers, but are arranged to work more quickly and give a more elastic blow as is required in steel drawing. All the working parts are of ample proportion and are made of the best material to insure the greatest durability. Double-acting, taking steam above and below piston, which is so arranged that it can be raised above top of cylinder to examine packing rings, or insert new ones, without disconnecting it from ram. Stuffing box joints at steam and exhaust connections.

Every hammer is tried with steam before leaving our works.

SIZE OF HAMMER (FALLING WEIGHT).	LENGTH OF STROKE.	USUAL FACE OF RAM OR RAM DIE.
500 pounds.	12 to 18 inches.	7¼ x 11 inches.
700 "	12 to 18 "	9 x 11 "
1,000 "	15 to 21 "	9 x 12½ "
1,250 "	17 to 24 "	10 x 15 "
1,500 "	20 to 30 "	10 x 16½ "
2,000 "	24 to 30 "	11 x 17 "

The shorter strokes are used for steel finishing. When larger steel working hammers than the above are required, the patterns of our standard sizes are used, making the necessary modifications in cylinder, valve gear, stroke, etc., for quicker action and the necessary elastic blow.

Complete foundation drawings furnished upon receipt of order.



700-POUND STEEL FINISHING STEAM HAMMER.

700-POUND STEEL FINISHING HAMMER.

With adjustable guides. Weight of drop and attached parts from 700 to 750 pounds, depending upon the length of stroke and kind of dies. Usual stroke for steel finishing, 12 inches; or for cogging, 18 inches. Double-acting, taking steam above and below piston. Valve is a flat slide, perfectly balanced and of great durability. Valve gear is simple and substantial, producing automatically or by hand, every desired variation in length, position, rapidity and force of blow. Greatest area of die surface, 11 inches by 9 inches. Piston rod and rings are of cast steel; piston and drop of wrought iron. By removing stops at upper end of guides, the piston may be raised above top of cylinder for insertion of packing rings without separating rod from drop. Every hammer tried with steam before leaving the works. Complete foundation drawings furnished free of charge. For further information in relation to steam hammers, reference should be made to the tabulated statement on a preceding page.

INSTRUCTIONS FOR SETTING, STARTING, RUNNING AND KEEPING OUR HAMMERS IN ORDER.

TO SET SINGLE FRAME HAMMERS.—Place the hammer over the anvil. Let the dies come together. Plumb the piston rod and adjust the anvil or bed plate, as most convenient, until the die faces match exactly; then insert the anvil keys, and screw fast to the foundation timbers with wood screws.

TO ERECT DOUBLE FRAME HAMMERS.—Place the ram upon the anvil with both dies keyed in. Clamp the frames together against the ram with paper interposed on each side for clearance; this gives correct alignment. Bolt on the cylinder, and tighten bed plate bolts and keys.

TO SET THE VALVE.—Place the latch handle central on its rack, and the ram at half stroke. The top of the valve should be $\frac{1}{8}$ inch above the upper steam port—if not so, adjust it by screwing or unscrewing valve stem. When properly adjusted, the steam *will hold the ram down on the anvil, or up against the bumpers*, by placing the latch handle at top or bottom of its rack.

TO START THE HAMMERS.—Use no tallow, but oil the cylinder and working parts. Open the drip cock. Place the latch handle at top of rack, and turn on very little steam. If the valve will not drop freely at first, pull it down by hand until the cylinder becomes well warmed. Close the drip, and practise the effect of different positions and motions of the handle, *with very little steam*, until familiar, then place a piece of board on the lower die to prevent injuring it, and strike a few good blows downward to jam the piston rod in the taper hole in the ram. The pin which goes through the rod and ram is only to hold while starting. The jam of the taper is the real hold. The rod is cut away a little above this pin to allow it to go down somewhat in the taper without touching the top of the pin. Be careful not to hammer *upwards*, or to strike the dies together carelessly *when cold*. At night, or when work stops, always leave the drip open, and the handle at the top of rack. This will prevent freezing.

EXAMINE THE PACKING RINGS in the piston every three months. They last nine to eighteen months. *To get at them*, remove the bumpers and the piston stuffing box packing. Raise the ram until the piston head rises out of the cylinder.

TO GET THE PISTON OUT OF THE RAM.—Raise the ram to the top of stroke, Secure a steel pin in the centre hole in its under side, against the bottom of the piston rod. Then allow it to drop upon the anvil. The pin will drive the piston out. Or use the drift pin, if arranged for one.

THE EXHAUST PIPE should incline downwards from the hammer, if possible, or a drain pipe be connected with it to draw off the water. *No cock in the drain pipe.*

THE STEAM PIPE should be well jacketed. Keep the machine well oiled, but use no tallow. About once a week the cylinder and valves should have a liberal dose of kerosene or benzine, administered through the oil cock. This will clean out any gum or dirt, which would otherwise clog the valves.

GENERAL DESCRIPTION OF STEAM DROP HAMMERS,

FOR EVERY VARIETY OF DROP FORGINGS, SWAGING,
CUTTING-OFF, ETC.

These hammers are all double acting, *i. e.*, they take steam above and below the piston, giving not only single or successive dead blows, like an ordinary power drop, but they may be run automatically, or by hand or foot, at any desired length of stroke, for light or heavy blows, in the same manner as our standard steam hammers, and without any change of adjustment. This is particularly valuable where drop, or stamp work and forging, or finishing, are to be done under different parts of the same die. Both hand lever and treadle are provided, no change in any of the connections being necessary to use either.

The normal position of the ram, when at rest, is at the top of its stroke, leaving all clear below it for changing dies and examining work. If a single blow is desired, a sharp downward movement of the hand lever, or treadle, causes the ram to fall, and when it is released, the ram rises to its original position promptly, but without a blow, owing to the partial closing of the throttle valve by the automatic gear, admitting only the small amount of steam required to suspend the ram. This feature—essential to the successful operation of a steam drop—is, with other improvements, protected by patents. As an additional safeguard, spiral steel buffers are used to stop the ram at the top of its stroke. To prevent breakage, due to continued concussion and jar, sufficient elasticity has been introduced at all necessary points. All fastenings are provided with spiral steel springs, and the adjustable guides, which are used to take up the wear of the ram and keep it in correct alignment, have also steel buffers to resist shocks.

These hammers admit of such fine adjustment, that small work can be done on a larger size as quickly and cheaply as on a much smaller one. When a number of forgings are to be made from one bar, and at one heat, the several forgings, thus made, can be

cut apart or trimmed, by an easy downward push of the ram, or by short light blows if preferred, without employing another machine, as is usually the case.

Belt or board drop hammers are often objected to on account of the cost and repairs of the necessary shafting, pulleys and belts required to run them. This is obviated by the use of steam, which can be carried a long distance by properly jacketed piping, run overhead or underground. The repairs, outside of the dies, are insignificant as compared with the cost of maintenance of any other hammer.

We build drops, with the necessary dimensions and die arrangements, to suit any special requirements, and of the following sizes, which represent the actual falling weight, namely: 400 pounds, 600 pounds, 800 pounds, 1000 pounds, 1200 pounds, 1500 pounds, 2000 pounds, 2500 pounds and 3000 pounds.

DOUBLE FRAME STEAM DROP HAMMERS,

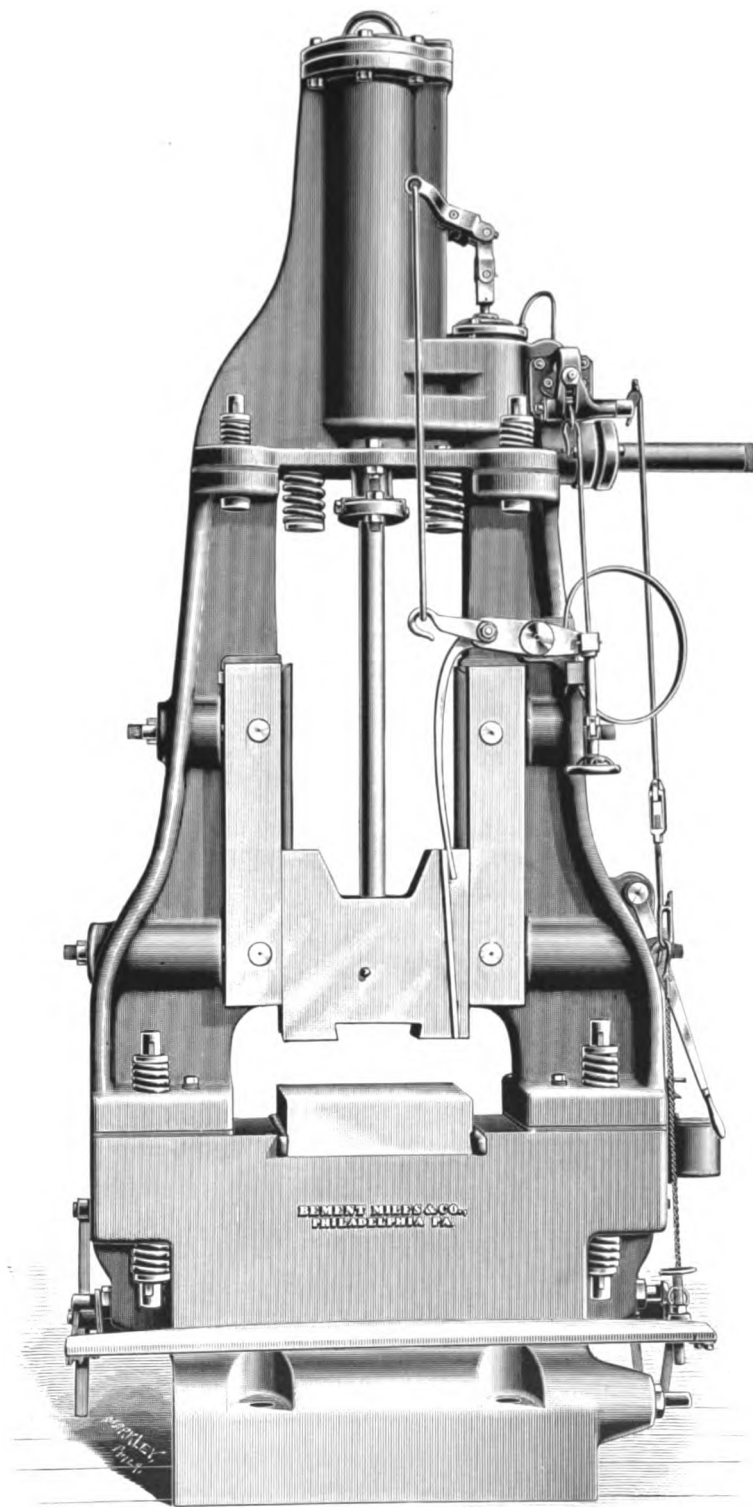
FOR STAMPING WORK IN DIES.

The frames are bolted to a solid anvil base, in which is planed the seat for the lower die. The ram carrying the upper die works between guide plates arranged so that they may be accurately adjusted for the purpose of taking up wear, and for matching the dies, which are thus held in the relation to each other necessary for stamping work in moulds or formers with accuracy; also for swaging journals, or other round work. Anvil caps are made of steel.

SIZE OF HAMMER (FALLING WEIGHT).	LENGTH OF STROKE.	FACE OF RAM OR RAM DIE.
400 pounds.	25 inches.	8 x 12 inches.
600 "	27 "	12 x 14 "
800 "	30 "	12 x 15½ "
1,000 "	36 "	14 x 18 "
1,200 "	36 "	14 x 20 "
1,500 "	42 "	16 x 20 "
2,000 "	45 "	16 x 24 "
2,500 "	48 "	16 x 28 "
3,000 "	48 "	16 x 28 "

These hammers are generally arranged with a patent treadle, the instructions for operating which can be found on another page.

Complete foundation drawings furnished upon receipt of order. In special cases, the housings will be placed further apart to increase the die surface.



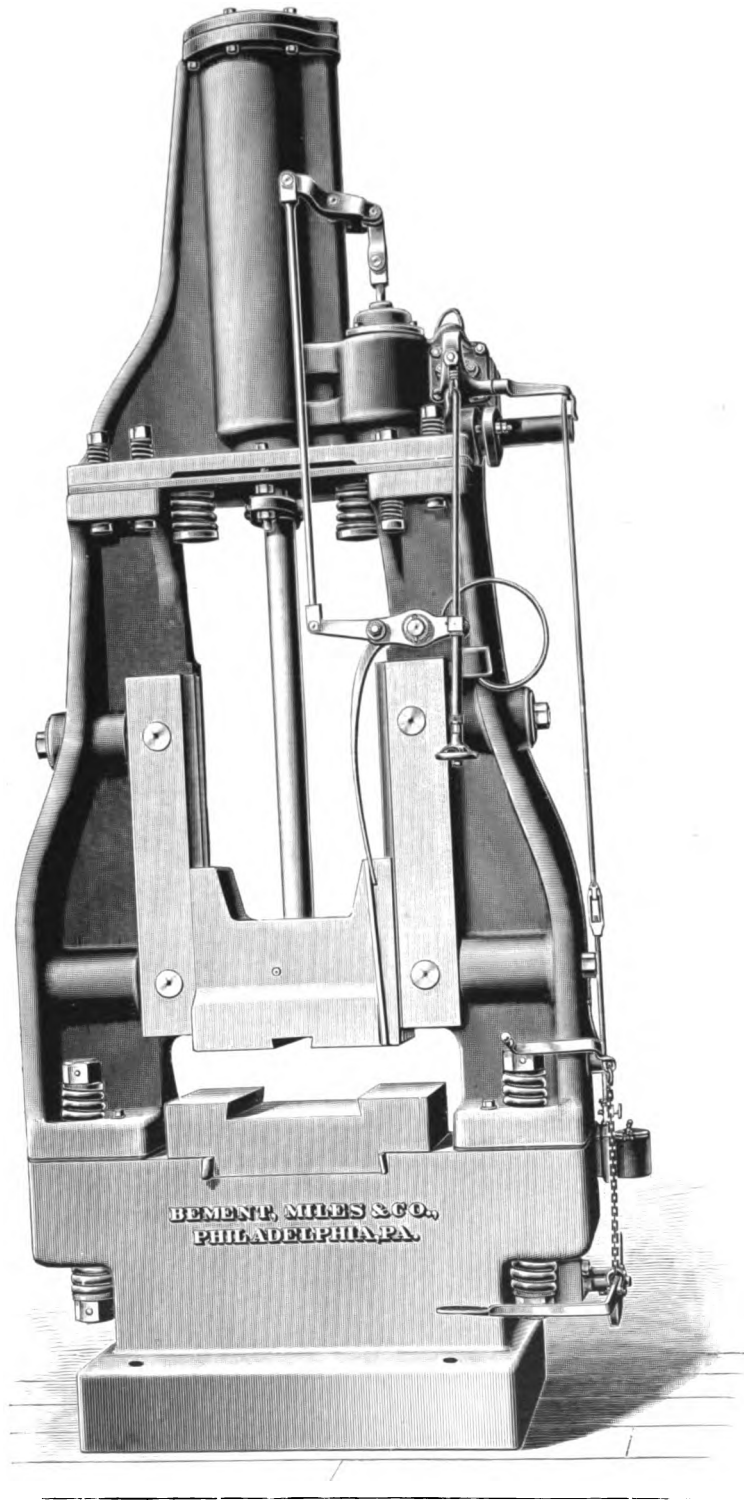
1000-POUND STEAM DROP HAMMER.

1000-POUND STEAM DROP HAMMER.

For all kinds of stamping, or for forging, when required, without change of gear. Stroke, 36 inches, and distance between guides, 18 inches. Takes steam above and below piston; valve is perfectly balanced, valve gear takes up its own lost motion as it wears, and operates automatically, or by hand, or foot. Adjustable guides are provided to take up the wear between drop and uprights, and taper shoes for matching the dies.

Every hammer is tried before leaving the works.

The above description applies equally well to the 400-pound, 600-pound, 800-pound and 1200-pound sizes; reference being made to the tabulated statement on another page, for length of stroke and die surface.



1500-POUND STEAM DROP HAMMER.

1500-POUND STEAM DROP HAMMER.

For all kinds of stamping, or for forging, when required, without change of gear. Stroke, 42 inches, and distance between guides, 20 inches. Takes steam above and below piston; valve is perfectly balanced; valve gear takes up its own lost motion as it wears, and operates automatically, or by hand, or foot. Adjustable guides are provided to take up the wear between drop and uprights, and taper shoes for matching the dies. Every hammer is tried before leaving the works.

The above description applies equally well to the 2000-pound, 2500-pound and 3000-pound sizes; reference being made to the tabulated statement on another page, for length of stroke and die surface.

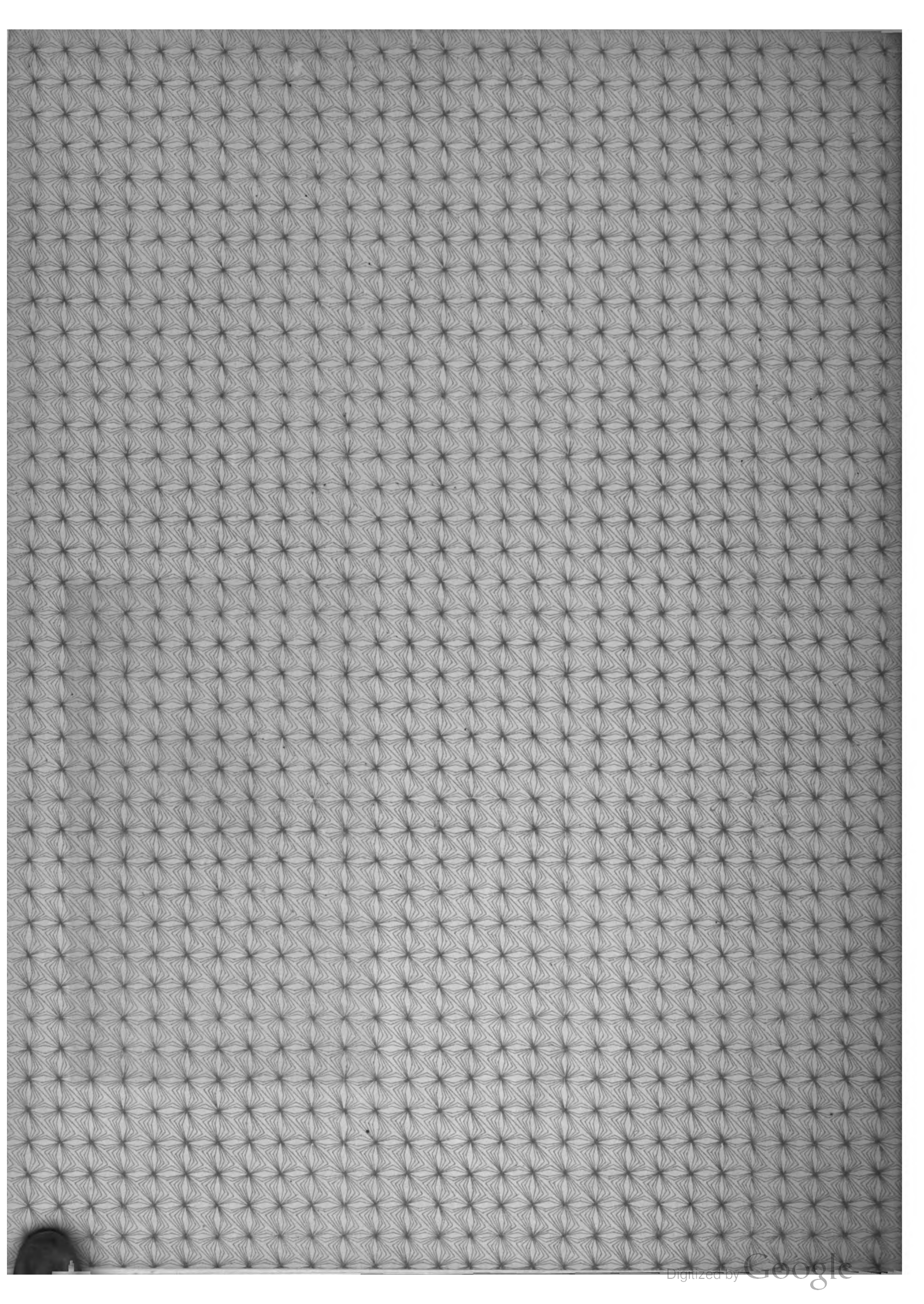
INSTRUCTIONS

FOR ADJUSTING AND USING THE PATENT STEAM DROP HAMMERS.

The upper rod to the main valve lever regulates, by means of the small hand wheel upon it, the position of the main valve; while the lower one, to the treadle, controls the admission of steam and serves to operate the hammer. This combination enables the ram to be suspended by the steam at any point of its stroke, and to be started with a sharp, downward blow. A single quick push downward on the treadle will strike a single blow and return; a steady pressure will cause a succession of blows, so long as the treadle is held down. At first starting, the upper rod should be so adjusted, by the small hand wheel, that the main valve lever stands horizontal. The treadle should then be operated cautiously, to work the water out of the cylinder and to ascertain the height of the stroke. If the hammer throws too high, the hand wheel should be screwed upward; or, if not high enough, it should be unscrewed downward.

Practice soon teaches the correct adjustment of the hand wheel for any desired stroke.

The hammer may also be worked by the hand lever, and the hand wheel varied to produce different effects, as described.



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