

NO. 49

SULLIVAN
DIAMOND
DRILLS

1901

SULLIVAN
MACHINERY
COMPANY
CHICAGO, U.S.A.

SULLIVAN DIAMOND DRILLS

CATALOGUE No. 49 ILLUSTRATED

for
The Rapid and Economical
Prospecting of Mines
and Mineral and
Quarry Lands

1901

SULLIVAN MACHINERY CO.
135 ADAMS STREET, CHICAGO, ILL., U. S. A.
(*Successors to* M. C. BULLOCK MFG. COMPANY)

BRANCH OFFICES

NEW YORK CITY, 71 Broadway. PITTSBURG, PA., 339 5th Avenue
DENVER, COLO., 431 17th St. SPOKANE, WASH., S 101 Howard St.

Eastern Works: Claremont, N. H.

Western Works: 1170 W. Lake Street, Chicago

Code Address, "DIAMOND, CHICAGO".

Codes used, *A1, ABC, Fraser & Chalmers, Lieber's, Commercial Directory
and Western Union*

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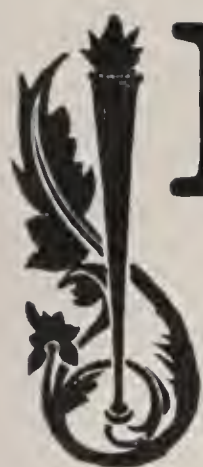
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INTRODUCTION



IT is between thirty and forty years since the SULLIVAN MACHINERY COMPANY began the manufacture of rock-working machinery, and during all these years the business has been steadily increasing, until to-day there is not a State in the Union in which we are not represented and in which our machinery is not well known. The policy of the SULLIVAN MACHINERY COMPANY is one of advancement with the times, and as we are continually studying the mining and quarrying requirements, improvements are made as the conditions change.

THE SULLIVAN DIAMOND PROSPECTING DRILL embodies all the latest improvements, suggested by our long experience in manufacturing as well as in operating such machines. This varied experience has enabled us to turn out a diamond drill having no equal for accuracy and reliability. Wherever advanced mining methods are in use the SULLIVAN DRILLS are well known and the large sale of them in the United States, as well as in most of the foreign countries, proves the extent of their reputation. In order to make the line as complete as possible, we are continually making new designs and improvements on the old; we now build machines with capacities for drilling holes ranging from three hundred feet to over one mile in depth, some of these being operated by hand, others by steam, compressed air, and electric power.

Our export trade has been very gratifying. Owing to the simplicity, strength and convenience of the SULLIVAN DRILLS they have proved themselves to be especially satisfactory for use at a great distance from a base of supplies, as they will run for years without breakdowns, which cause expensive and annoying delays. The machines are now used in Mexico, all the Central and South American Republics, Canada, Alaska, Siberia, Japan, Australia, Sumatra, Africa (we have exported more than two hundred drills to the Transvaal alone), Spain, France, Germany, Norway, etc. In filling export orders great care is taken to avoid omitting any detail, the absence of which might cause delay or trouble, and our record in this respect has been most satisfactory. All machines and accessories are carried in stock, and orders can be filled promptly. Correspondence is solicited and will receive our prompt attention.

SULLIVAN MACHINERY COMPANY.

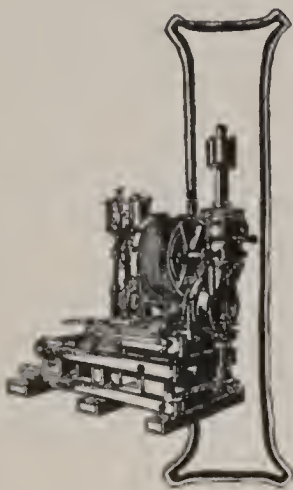
Catalogues Issued 1901

- No. 30. Rock Drills and Quarrying Machinery.
- No. 40. Portable Hoists.
- No. 41. Handpower Diamond Drill.
- No. 42. Heavy Hoists.
- No. 44. Mine Ventilators.
- No. 45. Corliss Engines.
- No. 46. Bullock Diamond Drills.
- No. 47. Air Compressors.
- No. 48. Coal Mining Machinery.
- No. 49. Sullivan Diamond Drills.

PART I

The Sullivan Diamond
Prospecting Core
Drill

The Diamond Drill: Its Advantages Over Other Prospecting Drills



IN the development of mineral property for coal or ore, one of the most important considerations is the preliminary "prospecting" by which the exact position, extent, thickness and value of the mineral deposits are ascertained. This is usually done by drilling holes from the surface, which is a quicker and cheaper method than drifting or sinking a shaft. It is now a well-established fact that the only reliable and satisfactory way of drilling prospect holes is by means of the DIAMOND CORE DRILL.

Other methods of prospecting, where the Churn Drill Process is used, are absolutely valueless, as far as reliable results are concerned. We can give many instances where sums of from one thousand to twenty-five thousand dollars have been thrown away in sinking shafts for coal on the records furnished by churn drills, the supposed vein of coal proving to be a black bituminous shale. It is impossible to determine accurately with the churn drill the difference between coal and black slate or shale if highly bituminous.

The Diamond Drill bores a perfectly straight, smooth hole to any depth or in any given direction from vertical to horizontal, bringing to the surface a solid section or "core" of all strata passed through, in order, showing their exact depth, thickness and the character of the rock. This core is large enough to be thoroughly examined and tested; and what is of almost equal value, if the mineral sought for is absent, the fact is determined beyond a doubt. It also gives positive information of the material that would be met in sinking a shaft to work the mineral whose presence has been determined, making it possible to estimate closely the cost of the shaft.

The requirements of a machine for such work are many and exacting. It must be strong, simple and durable, economical in use of steam and in the wear of the diamond points or "carbon," rapid in operation, and above all, its work must be accurate and reliable, so that the results derived from it will be known to be correct, as upon them depends the expensive process of sinking shafts and driving tunnels, as well as the investment of large sums of money in land.

Not only for prospecting from the surface, but for drilling in advance of levels underground; for sinking wells for gas, oil or water, especially where coal, salt or other minerals are also looked

for; in submarine work, for prospecting quarry lands and for many other special purposes, the DIAMOND DRILL is far superior to any other. Consequently, it is in general use, and is considered essential to the economical development of mineral lands, as possessing great advantages in time, accuracy and economy over any other method of prospecting.

General Features of the Sullivan Diamond Prospecting Core Drill

THE SULLIVAN DRILL fulfills all the requirements necessary for a diamond drill of the best design, and for the most efficient service. It possesses the most improved features of machines of this kind, many of them peculiar to itself, and the result of much observation and experience in practical work. Each machine, except in case of the smaller sizes, consists of three parts—the engines, the hoisting and the feed apparatus. These parts, although comprised in one machine, are yet distinct, and each can be operated independently of the others. They are mounted on a cast-iron base plate, which rests on a bolted and braced hardwood frame. The base plate slides back and forth on ways on the frame, moved by a hand lever working in a rack on the frame. By moving the drill back in this way it is out of the way of the rods while pulling them up and lowering them.

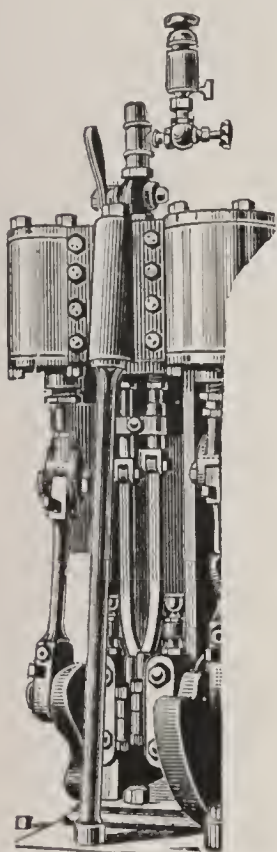


Fig. 1. Engines.

Engines. The engines were designed especially for these machines, with a view to simplicity, compactness and economy. They are vertical, two in number, set quartering, and can be driven by steam or compressed air. Their special feature is in the proportioning and adjustment of the valves, which ride upon each other between the cylinders, interact on each other in admitting and cutting off the steam, and are thereby balanced. This arrangement allows great compactness of the engines, an unusually quick opening and closing of the cylinder ports, and produces a correct distribution of steam for economy and smooth running. These engines are provided with a relief drip valve, by which all water can be drained from the steam pipes without entering the steam chest or cylinder, and with petcocks for draining the latter after steam is admitted to them.

The "E" and "S" drills are driven by single engines, well balanced and adapted to steam or compressed air.

The wearing parts of all the engines are few, and provided with ample means of lubrication and adjustment, so that repairs are not frequent. When necessary they can be made by any intelligent engineer or machinist; the drill runner, with the tools usually found in a drill outfit, can make all ordinary repairs.

Hoist. The hoisting apparatus in the larger machines consists of an iron drum, wound with wire rope, and with suitable combinations of gearing for hoisting the full weight of the rods from any ordinary depth without the necessity of using double blocks. The drum is controlled by means of a powerful wood-lined brake, operated by a hand lever and screw or cam, and adjustable for wear. The hoisting gears are disconnected while not in use for hoisting, to avoid unnecessary wear. In the "M" Hand Drill and the "E" Drill for underground prospecting, the rods are raised by hand power.

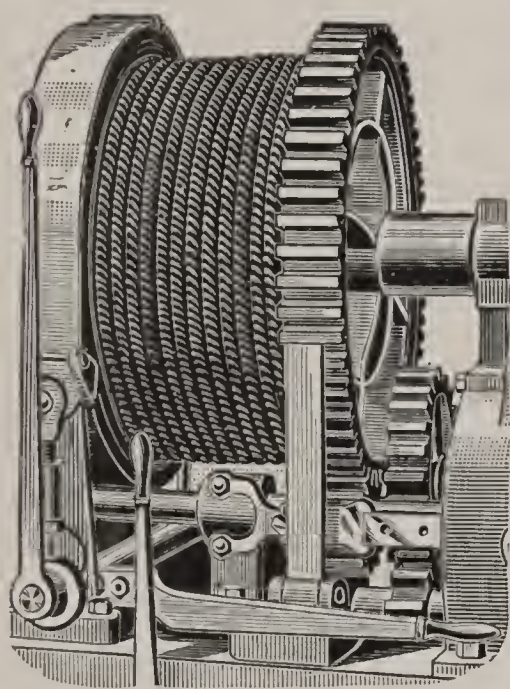


Fig. 2. Hoisting Drum "P" Drill.

We have designed a Combination Water Joint and Hoist Plug (Fig. 44). From its name and the accompanying illustration of the regular pattern, its use and construction will be clearly understood.

For use with a counterbalance rig, we supply a combination water joint and hoist plug, in which the friction washers between the top of the lifting bale and the double nuts are replaced by a ball-bearing; a portion of the weight of the rods is thus suspended from the rope running over the sheave at the top of derrick and the rods can be revolved rapidly without excessive friction.

Hydraulic Feed. For the advance or "feed" of the drilling bit, the *Single Cylinder Hydraulic Piston* feed is used on all larger drills. With the hydraulic cylinder the feed can be adjusted to any degree of nicety necessary to secure the best results in speed and accuracy. Referring to the sectional view of the feed apparatus (Fig. 4), it will be seen that its arrangement and operation are as follows:

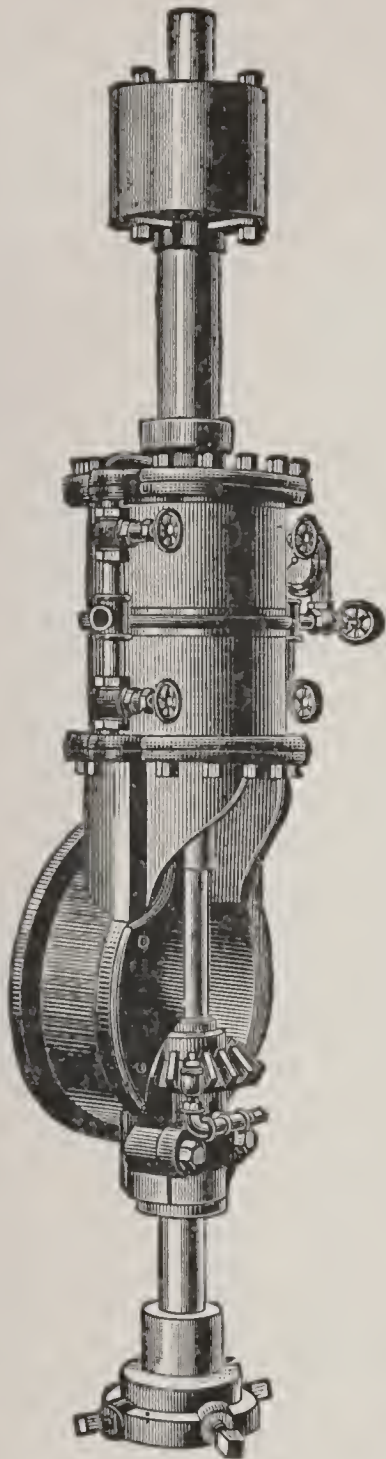


Fig. 3.
Hydraulic Apparatus.

A is the hydraulic cylinder, in which the piston, *B*, moves up and down attached to the piston rod, *C*, which moves with it. Connection to the pump is made at the tee, *D*, and to the escape at the tee, *E*, the water being let in and out through brass tubes, *F*, and ports cast in the cylinder heads. Valves 1 and 2 are the "inlet" valves, and 3 and 4 the "outlet" valves. When 1 and 3 are open, and 2 and 4 closed, water is pumped in above the piston and allowed to escape from below it, and the piston moves downward; when 2 and 4 are open and 1 and 3 closed, the piston moves upward.

To the upper end of the piston rod is screwed the thrust plate, *G*, through which pass three studs screwed into another thrust plate, *H*. Between the thrust plates are two sets of friction ball roller bearings—one set on each side of collar, *I*, on the drive rod, *J*. This collar transmits the vertical motion of the hydraulic piston to the drilling bit; for as the piston and piston rod descend they carry with them the two thrust plates, *G* and *H*, and the two roller bearings with the collar, *I*, between them. The collar is screwed fast to the drive rod, *J*, and rotates with it, the rod being driven by the miter gear, *K*, and a similar miter gear on the engine shaft. Thus the piston rod and drive rod descend together, the latter rotating within the former.

A long line of hollow "drill rods," made up of five foot or ten foot lengths, screwed together, extends from the diamond bit at the bottom of the hole, up to the drill, passing through the drive rod, *J*, and held up and rotated by means of a chuck, *L*, screwed to the bottom of drive rod. Therefore, as the engine runs, turning the miter gear and drive rod, the latter rotates within the hydraulic piston rod and descends with it, sliding through the miter gear, whose splines slide in grooves in the drive rod; and the drive rod, descending, carries with it the chuck, drill rods and drilling bit. Thus, by

admitting water, under pressure, to one side of the hydraulic piston, and releasing an equal amount from the other side, the piston can be moved either up or down; the downward or advance movement being called "feed."

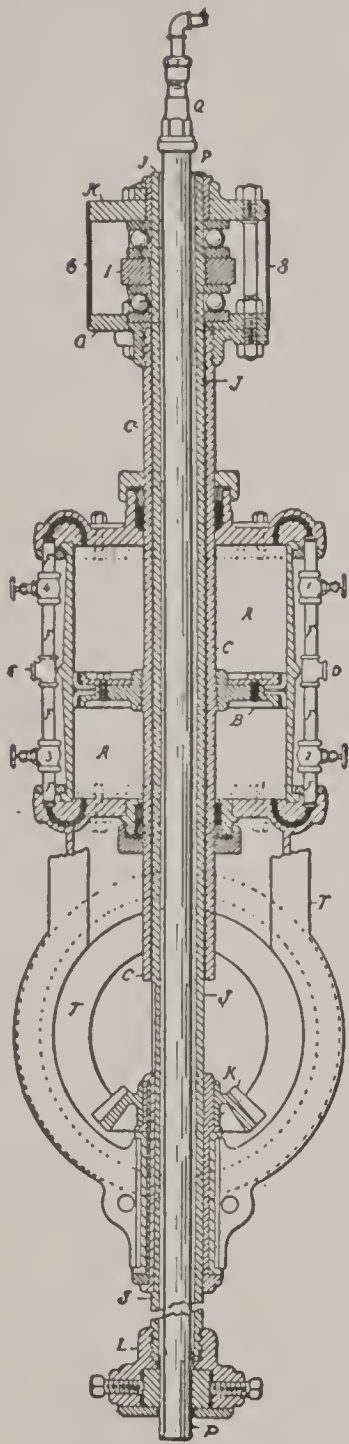


Fig 4.
Section of Hydraulic Feed
Apparatus.

Advantages of Hydraulic Feed. The advantages of hydraulic feed are many—for economy of time and saving of diamonds, and for great accuracy and safety in operation. The amount of water admitted to or released from the hydraulic cylinder can be varied to any degree by simply adjusting the inlet and outlet valves; and as the feed depends directly upon that amount, it follows that the feed can be adjusted with the greatest nicety. *This unlimited range of feed* is of the greatest importance, as by its means the operator, noticing at once any change in the hardness of the rock, shown by the gauges on the hydraulic cylinder, and indicated by the running of the drill, can immediately change the feed to exactly suit the new stratum penetrated; and, in entering softer rock, can take advantage of a faster feed, if only for a few inches. Thus he is enabled to use skill and judgment to secure the most rapid and satisfactory progress.

The fact that the *feed apparatus is entirely independent of the engines* adds another element of economy to the SULLIVAN DRILLS, as feed can be increased, diminished or *reversed*, while the drill is running, without loss of time. This fact adds also to the safe running of the machine, as in case of threatened wedging of the bit it allows the rods to be *kept turning*, while the feed may be stopped or reversed, until the bit cuts clear.

The hydraulic feed, operated by a *constant pressure*, rather than a *constant rate of advance*, allows the drill to run with slightly slower feed on suddenly entering hard rock, when the runner can at once give the amount of feed the rock will take without injury to the diamonds. Thus the hydraulic feed avoids shocks and jars, and

consequent danger of breaking or wrenching out diamonds when drilling in rocks of different degrees of hardness.

No Drop of Drill Rods. The construction of the hydraulic cylinder and piping is such that the water cannot escape from bottom of cylinder faster than it enters at the top. Hence the lower part of the cylinder is *always full of water*; and, in case a cavity is struck, the weight of the drill rods, hanging on the piston, is supported by this body of water, which is *incompressible* and *prevents entirely the dropping of the rods*. When a cavity is struck, the hydraulic feed continues downward as regularly as in drilling through hard rock.

Advantage of Single Hydraulic Cylinder. By the use of a single cylinder, with drill rods passing through its center, the line of pressure is always kept directly in the line of drill rods, avoiding cross strains and reducing friction.

Indicating Gauges. The SULLIVAN DRILLS are provided with gauges which indicate at once the pressure on the bit and condition of the core. This prevents grinding away the core, and at once indicates to the runner any change in the formation.

Friction Roller Bearings. An important detail of the hydraulic feed drills is the friction roller bearing, shown in Fig. 4 and in the accompanying perspective view, Fig. 5. It consists of two sets of hardened steel balls, ground round and true, which run in grooves in steel plates, also hardened and ground. One set sustains the weight of the rods when they hang in the drill chuck; the other set sustains the upward thrust of the rods in drilling. This device reduces to a minimum the amount of work lost in friction, leaving the whole power of the engines to be devoted to drilling. The friction roller bearing is inclosed in a sheath, which keeps it free from dirt and water.

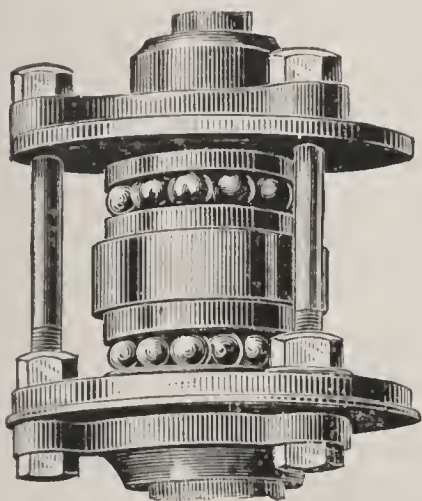


Fig. 5.
Friction Ball Roller Bearing.

Friction Feed. As the hydraulic feed is not applicable to the smaller machines, another form has been used in their design. It is a friction feed, not hitherto applied to diamond drills, which consists of a system of differential gearing, driven by *friction*, instead of being "positive." The driving power from drill spindle to countershaft is transmitted through leather washers on either side of the loose upper

countershaft gear. In feeding, the gear and washers are pressed against a collar below them on the countershaft, by tightening a compression spring. This spring is coiled in a sleeve, which is keyed to the countershaft above the upper gear. When the spring is compressed the countershaft revolves with the upper gear and washers, at a speed determined by the amount of compression, the lower countershaft gear turning the feed nut gear; and as the amount of compression of the spring, and consequently, the friction of the washers, can be increased or diminished at will, it follows that the feed can be varied up to any limit fixed by the proportions of the feed gears.

This feed has drilled many thousand feet in jasper, quartzite and gneiss, as well as in soft formations, with very satisfactory results; for the "friction" element of this arrangement, like the hydraulic feed of the larger SULLIVAN DRILLS, allows the same careful regulation of the feed, to secure the best results in all kinds of rock without danger to the diamonds. The friction feed is used with "E," "M," "R," "R S," "H G" and "S" drills.

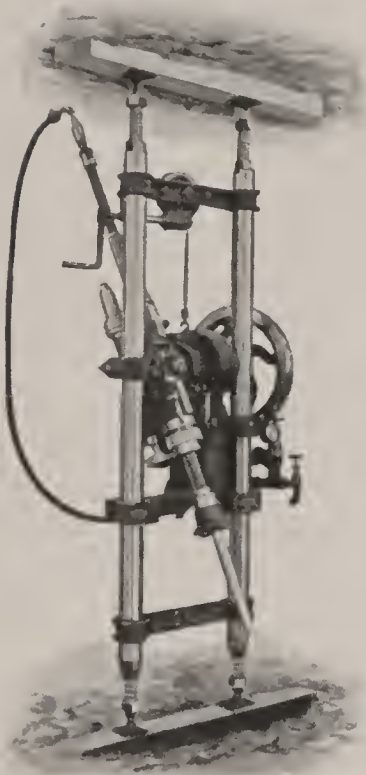


Fig. 6.
Sullivan "E" Under-
Ground Drill.

Simplicity of Design. In designing and building these machines, it has been the aim to make them simple, and of strong, durable material, with all parts easily accessible. This is especially necessary in machines of this character, which are frequently subjected to rough usage in mines, backwoods or mountainous country, in remote places, where any breakdown might entail great loss of time. As, however, an occasional mishap cannot be avoided, all parts are made to gauge, by jigs and templates, and hence are interchangeable. The parts most liable to need replacing are kept in stock at store or factory, and any piece can be forwarded at once on receipt of telegraphic order.



Fig. 7.
Sullivan "M" Hand-power Drill.

The Skill Required to Operate the SULLIVAN DIAMOND PROSPECTING DRILLS is not unusual in amount. Any man of ordinary intelligence, with a fair knowledge of engines and machinery, can run one of these drills for ordinary prospecting. For deep drilling, it is well for the man in charge to have the experience that comes from ordinary prospecting, in order that he may be prepared for any contingencies that may arise. In all cases where a machine is sent out to be used by those unfamiliar with diamond drills, we recommend the purchaser to engage an experienced operator, whom we can always provide, to take charge of the drill for a few weeks and to instruct the purchaser's operator thoroughly in the running of the machine and the setting of diamonds. This plan is always economical in the end; for while the drills can be operated by those not familiar with them, as explained above, yet the knowledge gained from a competent instructor enables a new operator to make much more rapid progress, with less danger of accidents, than would be possible with a knowledge due only to a few weeks' personal experience.

With the foregoing general description of the SULLIVAN DRILL, and the details of each machine already given, a good idea can be had of their qualifications for perfectly satisfactory work. We shall be glad to furnish any further information if it is desired.

Prospecting by Contract with the Diamond Drill

We wish to call attention to the fact that we are contractors for the use of the SULLIVAN DIAMOND PROSPECTING DRILLS in all kinds of Diamond Drill work. On page 6 we refer to the many advantages gained by prospecting with the diamond drill; among them are the economy in time and expense over the method of prospecting by shafts, tunnels or drifts, and especially in accuracy of results over the old method of prospecting with a churn drill. The core obtained by a diamond drill is not only a correct and accurate record of the mineral sought for, but a record also of the material which a shaft will have to penetrate to reach the mineral. By means of the core the value of the mineral and the cost of a shaft or tunnel to it can be accurately determined in advance, and for this purpose the core may be preserved in boxes, each piece in its proper position with regard to depth. Core preserved in this way is often one of the best arguments that can be used for inducing capitalists to invest in mining enterprises.

For the past fifteen years we have been actively engaged in prospecting work, in which we have gained a wide and varied experience. We have from five to ten drill outfits in active operation on contract work, and can always arrange to take up new work promptly and push it through to a rapid and satisfactory conclusion.

By our policy of keeping our drill men constantly employed, so long as they prove competent and satisfactory, we have secured a corps of sober, reliable men, who are thoroughly conversant with the geological formations of the country. We can furnish men who have a thorough knowledge of the gold and silver mining regions of Lake Superior, Colorado, Dakota, Montana, Canada, Mexico and other points west and northwest; the iron regions of the Vermilion, Menominee, Gogebic, Marquette and other ranges, and of New York, New Jersey and the South; the rock salt formations of the West and South; and the coal formations of the entire country. Our experience has extended also to prospecting for sulphur, asphalt, ochre, pyrites, talc and other minerals, and to quarry prospecting, of which we make a specialty.

From these facts, and with the improved machinery and tools which we use, we are able to guarantee reliable, prompt and satisfactory work.

We take pleasure in calling attention to the fact that our contract work since 1884 has amounted to about *two hundred and sixty-five thousand feet*, or over *fifty miles* of core drilling. More than 26,000 feet of this work has been done for one company in Iowa, 16,000 feet for one in Illinois, 8,500 for one in Tennessee, etc.

We solicit correspondence in regard to prospecting mineral and quarry properties, sinking wells of all kinds, submarine work, drilling mine ventilating and drainage holes, making engineer's tests of masonry, and all work to which the DIAMOND DRILL is applicable. We will furnish estimates of cost on receipt of information as to the conditions of work to be performed.

When Inquiring in Regard to Contract Prospecting

Give all the data mentioned on page 54; also state amount of work which will be guaranteed, minimum depth of hole, distance of location from railroad freight station, general character of country as regards hauling of machinery, rate per day for teams, availability of boarding places for men, and similar information.

A Detailed Description

of each of the

Sullivan and Bullock Diamond Drills *showing* Capacities, Prices and Weights

will be found on the following pages

The capacities of the drills as given show the diameter and depth of hole each machine will bore when fitted in the regular manner.

In every case the drill can be equipped with larger fittings, which will produce a core of greater diameter, but also necessarily lessen the depth to which the machine will penetrate.



Fig. 8.

**Sullivan Diamond Prospecting Core Drill
Size "M" (Hand Power)**

Capacity, 300 ft. depth.

Diameter of hole, $1\frac{9}{16}$ in.

Diameter of core, $\frac{1}{8}$ in.

Sullivan Diamond Prospecting Core Drill Size "M" (Hand Power)

To meet the demand for a cheap but accurate Diamond Drill, suitable for shallow holes, and also for work in rough country where a steam drill and boiler could not be transported, we have designed the "M" Drill, operated by hand power, or by belt from a horse power or from a portable or agricultural engine. Weight of Drill without hoist, 190 pounds.

The "M" Drill shown on page 16 is mounted on hollow standards, with hollow back braces—an arrangement which combines strength, rigidity and light weight. Binding clamps allow change of position along the standards, and there is a swivel joint in line with the crank shafts, so that the proper setting can be had to bore a hole at any angle. It is built with the same care as the larger and more expensive drills and will do as accurate work. By means of the cranks shown in the cut, a hole can be drilled of the size and depth specified on opposite page; or by belt power a somewhat greater depth can be reached.

The hand-power hoist shown in the cut, and consisting of gears, drum and wire rope with hook, attached to back legs of drill, is not included in the regular drill equipment. It is a valuable article of extra equipment if holes are to be drilled to a considerable depth, as it permits pulling out the drill rods more quickly and easily than when done by common ropes and blocks.

When desired this drill can be equipped to operate by horse power.

For price of hand hoist, see page 92.

For equipment furnished with the "M" Drill and included in the price shown on page 47, see page 49.

For shipping weights and dimensions, see page 50.

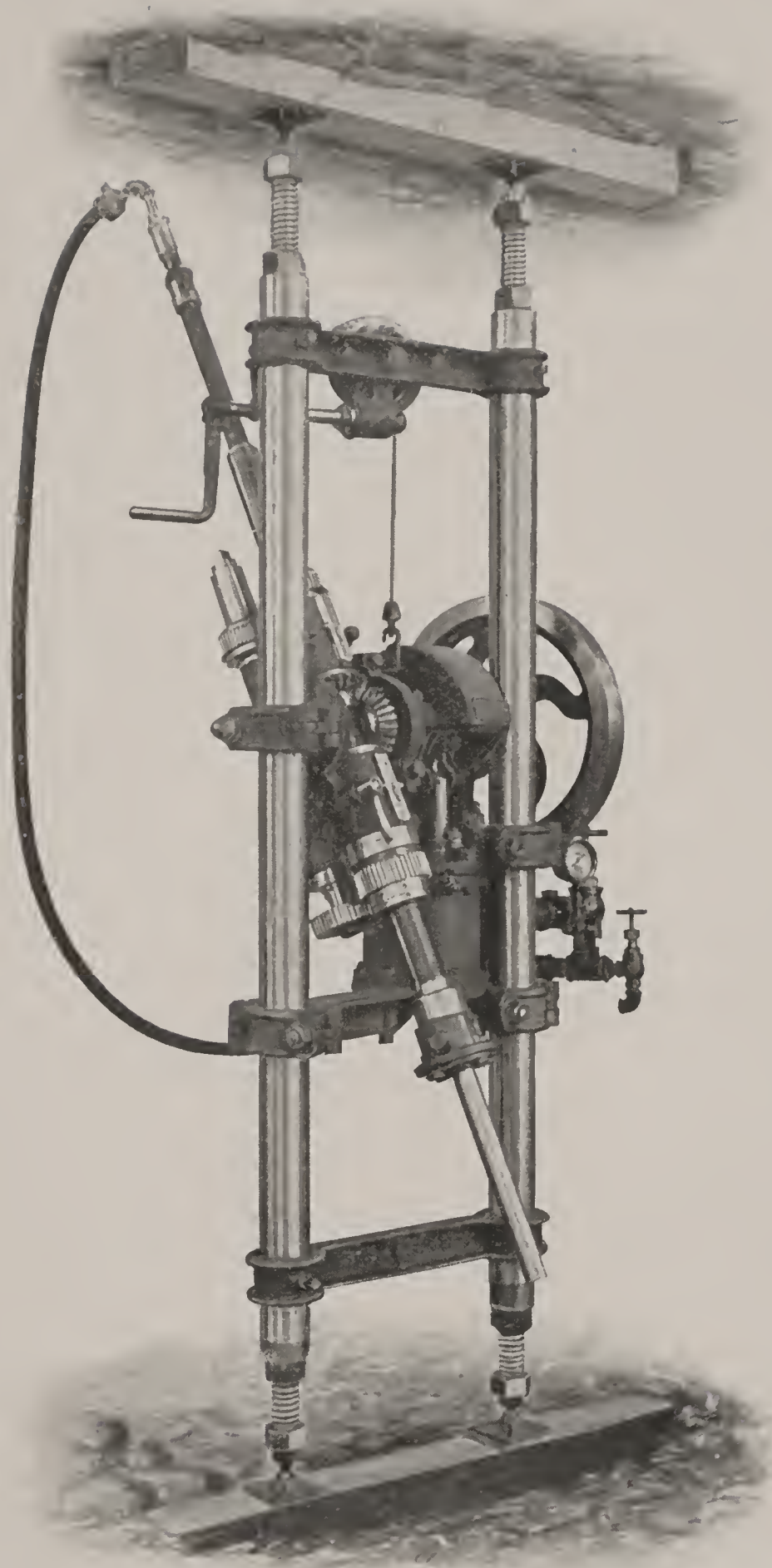


Fig. 9.

**Sullivan Diamond Prospecting Core Drill
Size "E"**

Capacity 400 ft. depth.
Diameter of hole, $1\frac{9}{16}$ in.
Diameter of core, $1\frac{5}{16}$ in.

Sullivan Diamond Prospecting Core Drill Size "E"

The "E" drill was designed especially for underground prospecting, which is carried on very generally in mines that are systematically and economically operated. For this work the Diamond Drill must have many of the features of a drill for surface prospecting, and in addition it must be capable of being operated in a small space; and it must be light and easily taken apart, so that it can be transported from place to place underground without difficulty and without loss of time.

Our "E" Drill possesses all these requirements. It is supported directly between the standards, so that the line of greatest pressure coincides with the line of greatest resistance, and there is no tendency for the drill to twist and get out of line with the hole. In addition to the resistance to pressure given by the standards, there is a system of braces, not shown in the cut, which are adjusted directly opposite to the thrust of the rod, thus making the drill rigid when drilling at any angle.

Especial attention is called to the small size and light weight of this machine, as given below, and to the fact that it can be taken apart or set up in 15 minutes, showing how well it is adapted to underground work.

Weight.

Weight of drill complete, set up.....	580 lbs.
Heaviest piece	125 "
No other piece weighs over.....	75 "

Working Space Required.

Length in line of drill rods.....	6 ft. 6 in.
Width	2 " 2 "
Height	5 " 8 "

By using 12-inch runs instead of 20-inch, the distance required in line of drill-rods is 5 feet 2 inches.

The "E" Drill has met with great favor in the gold and silver mines of the West and in the iron mines of the Lake Superior region, New York and New Jersey.

For equipment furnished with the "E" drill and included in the price shown on page 47, see page 49.

For shipping weights and dimensions, see page 50.

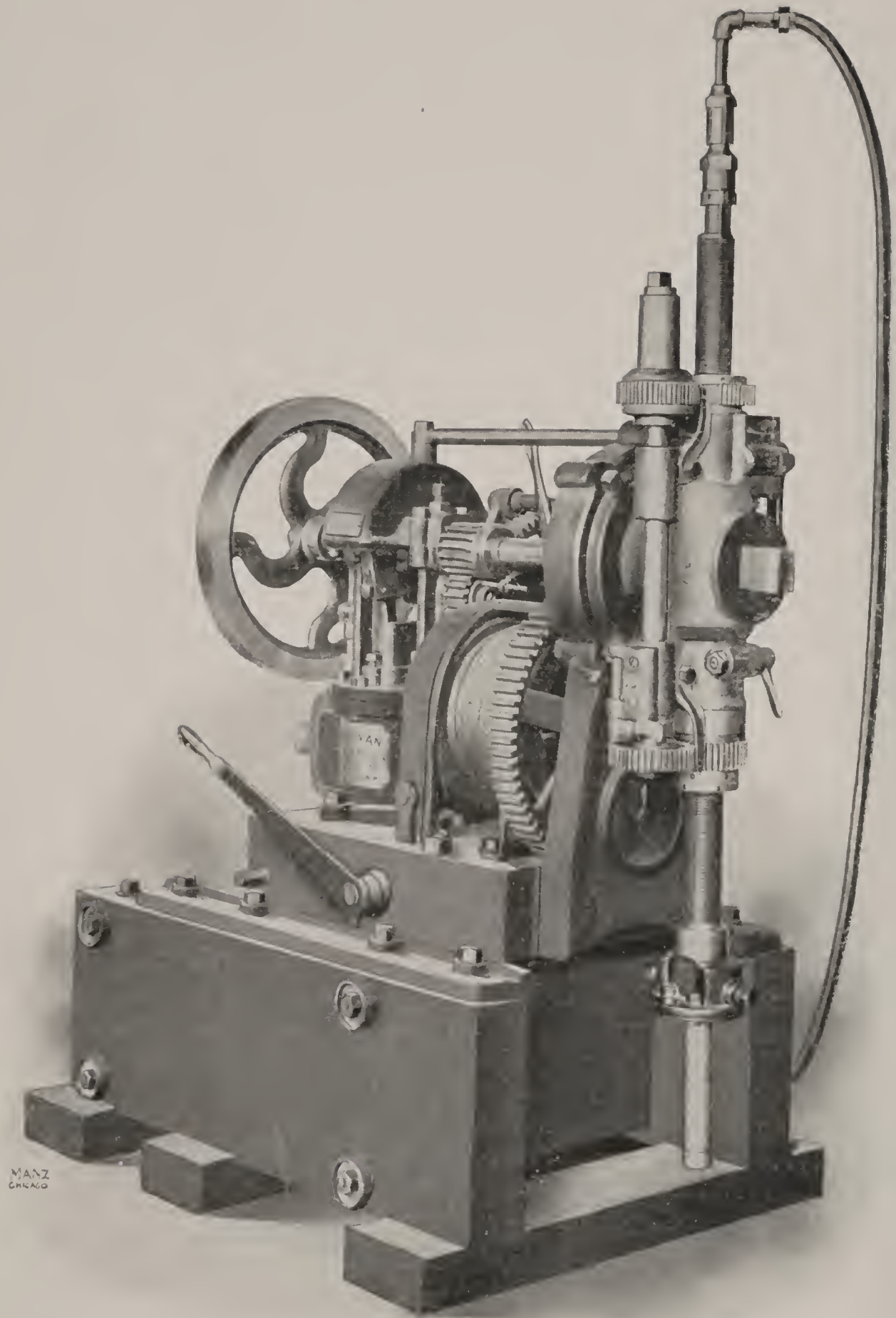


Fig. 10.

**Sullivan Diamond Prospecting Core Drill
Size "S"**

Capacity, 500 ft. depth.

Diameter of hole, $1\frac{9}{16}$ in.

Diameter of core, $\frac{1}{8}$ in.

Sullivan Diamond Prospecting Core Drill Size "S"

In order to provide a Diamond Drill possessing some of the features of both surface and underground prospecting drills, we have designed the "S" Drill. It has a frame and hoist similar to those used on our hydraulic feed surface prospecting drills, and it has our patent friction feed, which is compact for underground work. Its friction feed, described on page 11, is safe and rapid in its operation, and economical in wear of diamonds.

The "S" Drill can be used to advantage either on the surface or underground, and will be found especially convenient for first examining the property and afterward for use underground in locating new ore bodies.

For equipment furnished with the "S" Drill, and included in the price shown on page 47, see page 49.

For shipping weights and dimensions, see page 50.

Testimonial Letters: "S" Drill

Easy to Operate and Have Cost Nothing for Repairs

CIA DE INGUARAN, SOCIEDAD ANONIMA FRANCESA.
Con Capital de 3,500,000 francos.

INGUARAN, MEXICO, Oct. 29, 1898.

SULLIVAN MACHINERY Co., *Chicago, Ill.*

DEAR SIR: Referring to your favor of the 13th instant, we are pleased to say that we are using two of your Diamond Drills, size "S," with entire satisfaction. They are easy to operate and have cost us nothing for repairs. Although 350 feet is given as their capacity, we have attained a depth of 520 feet without injury to the machine.

Yours truly,

INGUARAN COMPANY,
J. L. PHILLIPS, *Director.*

Especially Serviceable for Prospecting Underground

THE EUSTIS MINING COMPANY.

W. E. C. EUSTIS, President.

JOHN BLUE, Superintendent.

EUSTIS, P. Q., CANADA, Oct. 28, 1898.

MESSRS. SULLIVAN MACHINERY COMPANY, *Chicago, Ill.*

DEAR SIR: We have had one of your Diamond Drills, size "S," in use for several years, and it has always done satisfactory work. It is especially serviceable for prospecting underground, occupying but little space, is easily moved and handled, and can be set up to drill in any direction.

Yours truly,

JOHN BLUE.

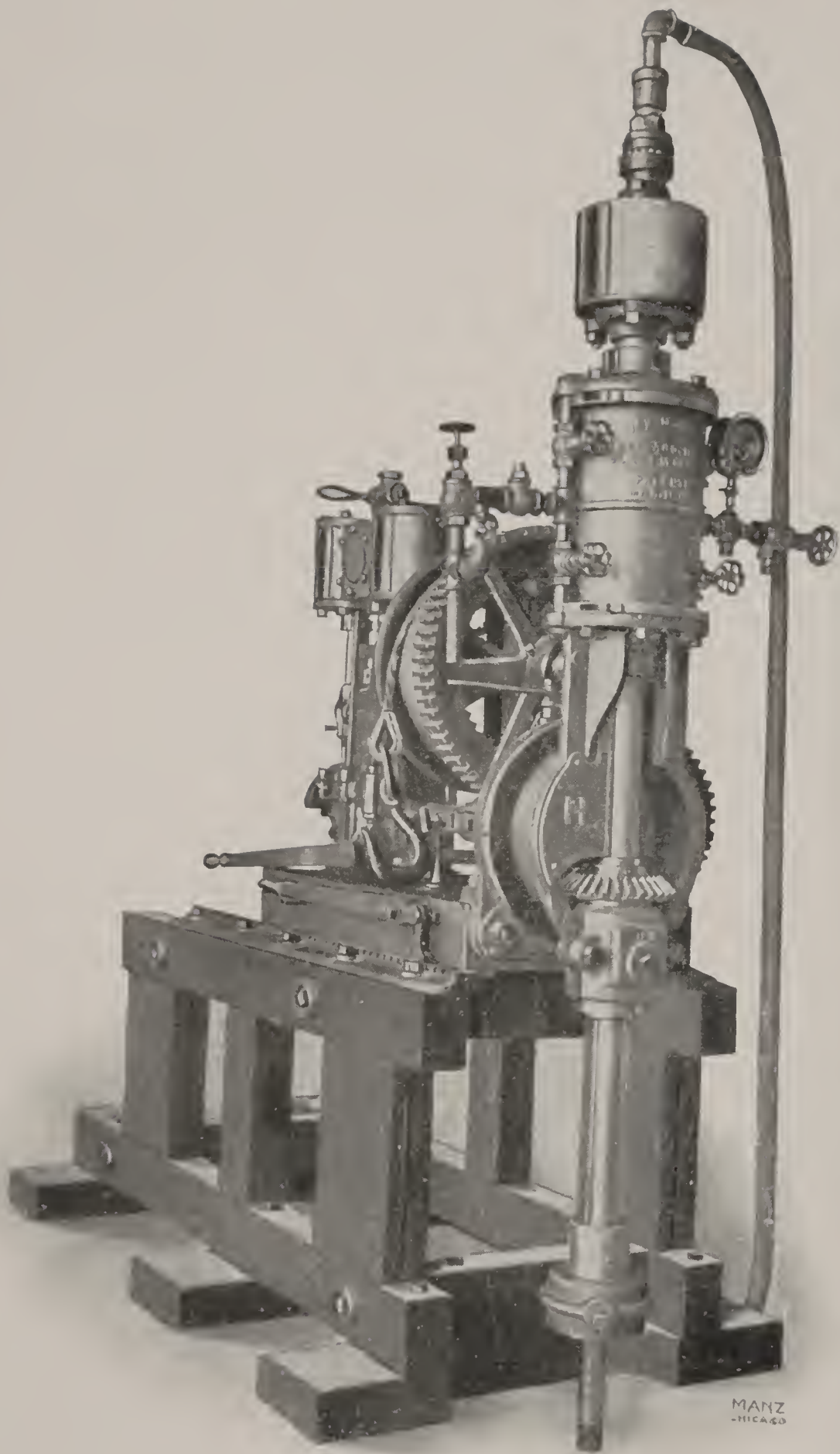


Fig. 11.

**Sullivan Diamond Prospecting Core Drill
Size "H"**

Capacity, 1,000 ft. depth.

Diameter of hole, $1\frac{1}{8}$ in.

Diameter of core, $1\frac{1}{8}$ in.

Sullivan Diamond Prospecting Core Drill Size "H"

The "H" Drill shown here is without doubt one of our most popular machines. It is designed for surface prospecting but in many cases has been used underground and is well adapted for this work.

For equipment furnished with the "H" Drill, and included in price shown on page 47, see page 48.

For shipping weights and dimensions, see page 50.

"H" Drill, mounted on wheels, see page 26.

Testimonial Letters: Size "H"

An Important Adjunct to the Equipment of Any Mine

BUNKER HILL AND SULLIVAN MINING AND CONCENTRATING
COMPANY.

MINES AND WORKS AT WARDNER, IDAHO.

F. W. BRADLEY, Manager.

KELLOGG, IDAHO, Oct. 25, 1898.

SULLIVAN MACHINERY Co., *Chicago, Ill.*

DEAR SIR: Replying to your letter of the 13th inst., we beg to state that we have recently drilled 5,000 feet in our mines with one of your Diamond Drilling Machines, size "H." We have found the machine to do excellent work in every respect, and we consider it an important adjunct to the equipment of any mine.

Yours truly,

BUNKER HILL & SULLIVAN M. AND C. CO.

The Machine of Greatest Value in Locating Clay Veins

CHRISTY FIRE CLAY CO.—WASHED CLAYS A SPECIALTY.

CALVIN M. CHRISTY, President.

W. C. MORRIS, Vice-President and General Manager.

FRANKLIN P. JONES, Sec'y and Treas.

VINCENT P. RING, General Agent.

R. D. HATTON, Ass't Sec'y.

ST. LOUIS, Oct. 17, 1898.

SULLIVAN MACHINERY Co., *Chicago, Ill.*

GENTLEMEN: We feel that you would be interested to know that the Diamond Drill outfit purchased from you in 1892 has rendered us very valuable service, enabling us to locate clay veins on our property to an extent that warranted the installation of a new mining plant, the development work in which has verified the prophecies of your drill. We consider your machine of the greatest value in work of this character.

Yours truly,

W. C. MORRIS, *Vice-President and General Manager.*

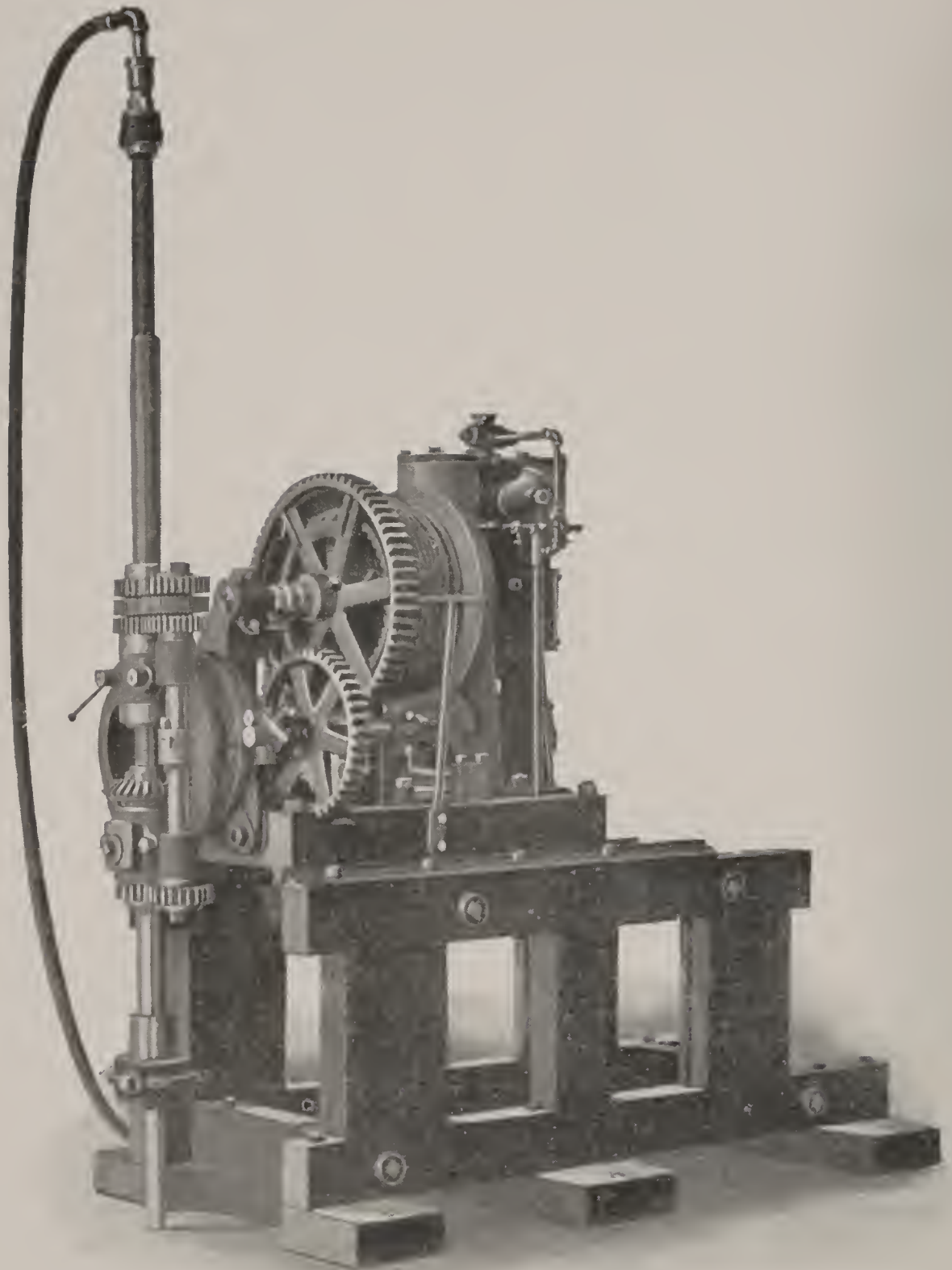


Fig. 12.

**Sullivan Diamond Prospecting Core Drill
Size "HG"**

Capacity, 1,000 ft. depth.
Diameter of hole, $1\frac{3}{16}$ in.
Diameter of core, $1\frac{1}{8}$ in.

Sullivan Diamond Prospecting Core Drill Size "HG"

This machine is one of our later designs—a modification of the "H" Drill, having the same capacity and general design, but provided with our improved friction feed.

The feed gears and countershaft are so constructed that the change from one rate of speed to another can be made while the drill is running, by simply shifting a single handle controlling the countershaft.

This arrangement allows the same careful regulation of feed as in the larger hydraulic feed drills, and has been used with very satisfactory results through many thousand feet of jasper, quartzite and gneiss, as well as the softer formations.

For equipment furnished with the "HG" drill and included in the price shown on page 47, see page 48.

For shipping weights and dimensions, see page 50.

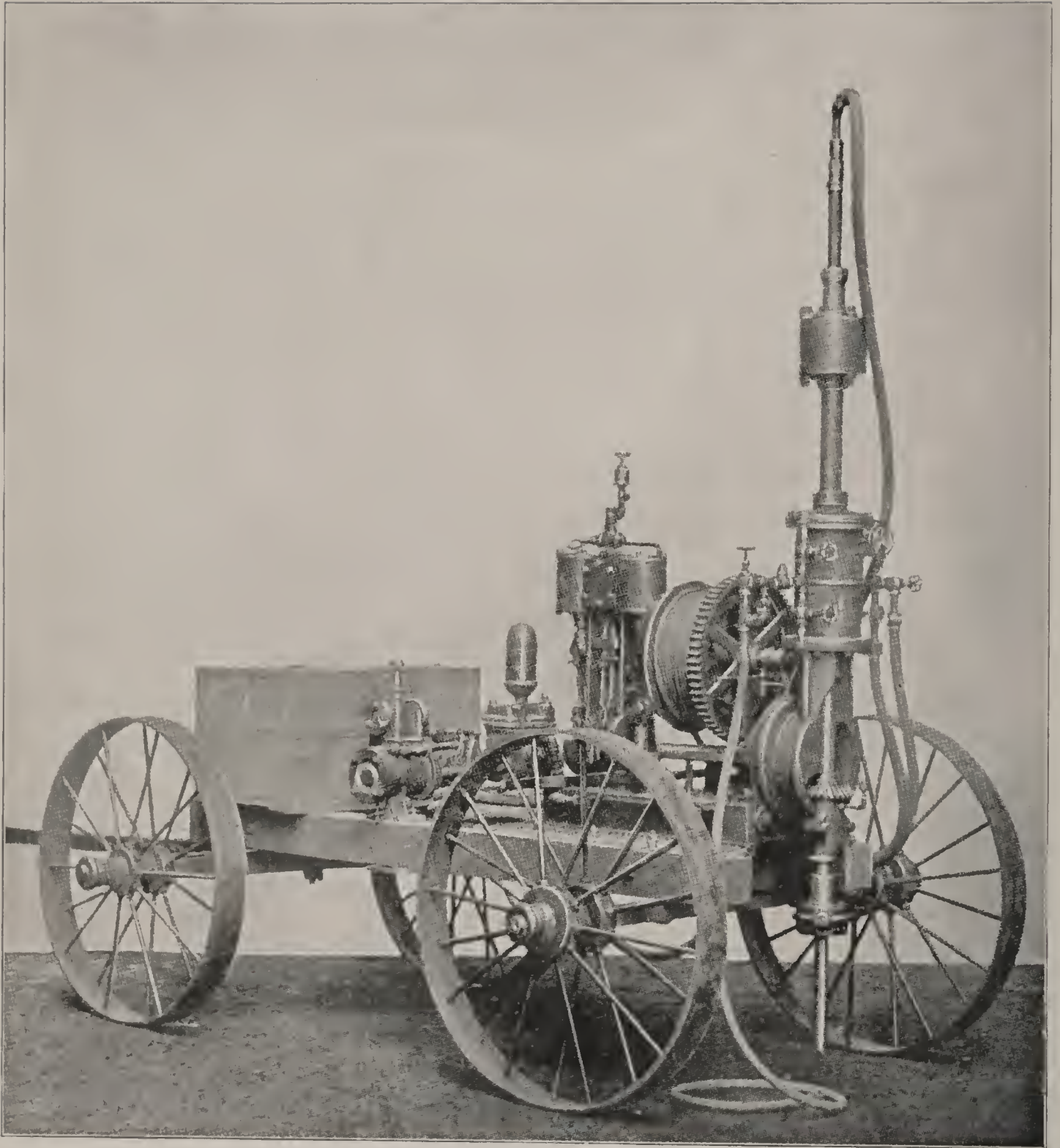


Fig. 13.

**Sullivan Diamond Prospecting Core Drill
Size "H," Mounted on Wheels**

Capacity, 1,000 ft. depth.
Diameter of hole, $1\frac{3}{8}$ in.
Diameter of core, $1\frac{1}{8}$ in.

Sullivan Diamond Prospecting Core Drill Size "H," Mounted on Wheels

Any of our forms of core drills, except size "K," can be mounted on wheels, if desired. This is sometimes an object where large numbers of shallow holes are to be drilled, necessitating frequent moves. Having the drill securely mounted on wheels saves time loading, unloading and setting it. The opposite cut shows an "H" Drill mounted on wheels, with pump and tool-box attached. This mounting is especially advantageous for rapid moving where a number of holes of medium depth are desired.

Weight of wheel mounting (wheels, axles and frame), 2,264 lbs.
Further data on this subject can be furnished if desired.

Price for mounting Drill on wheels, for sizes up to and including "N" Drill.....\$125.00
For mounting "P" Drill..... 200.00

Testimonial Letters: Size "H"

Drill in Constant Use for Two Years—Has Given Every Satisfaction

PROVINCE OF NEW BRUNSWICK, CANADA.
CROWN LAND DEPT.

FREDERICKTON, Oct. 27, 1898.

SULLIVAN MACHINERY Co., *Chicago, Ill.*

GENTLEMEN: Referring to the Diamond Drill, purchased by the Government of New Brunswick, from your company early in 1897, I would say that the drill has been in almost constant use ever since its receipt, and I have much pleasure in informing you that it has given every satisfaction. Yours truly, A. T. DUNN, *Surveyor-General.*

No Claim Made Which the Drill Did Not Fulfill

ELKO, NEVADA, Nov. 14, 1898.

SULLIVAN MACHINERY Co., *Chicago, Ill.*

GENTLEMEN: I take pleasure in adding my testimony to that of others as to the work of your machine. I can say that although the conditions under which it was used were very trying, the ground very bad, etc., there was no claim made for the machine which it did not fulfill. During the three months in which it was in use there was not one cent expended upon it for repairs. No carbon was lost, and the machine, with its sets of diamonds, is now ready at a moment's notice, for another campaign. It would be difficult to place a drill in more trying ground than the shattered slaty-shale in which we used it. I consider it the very best of its class. Very truly yours,

G. H. ARLETT, *Superintendent Lone Mountain Mine.*

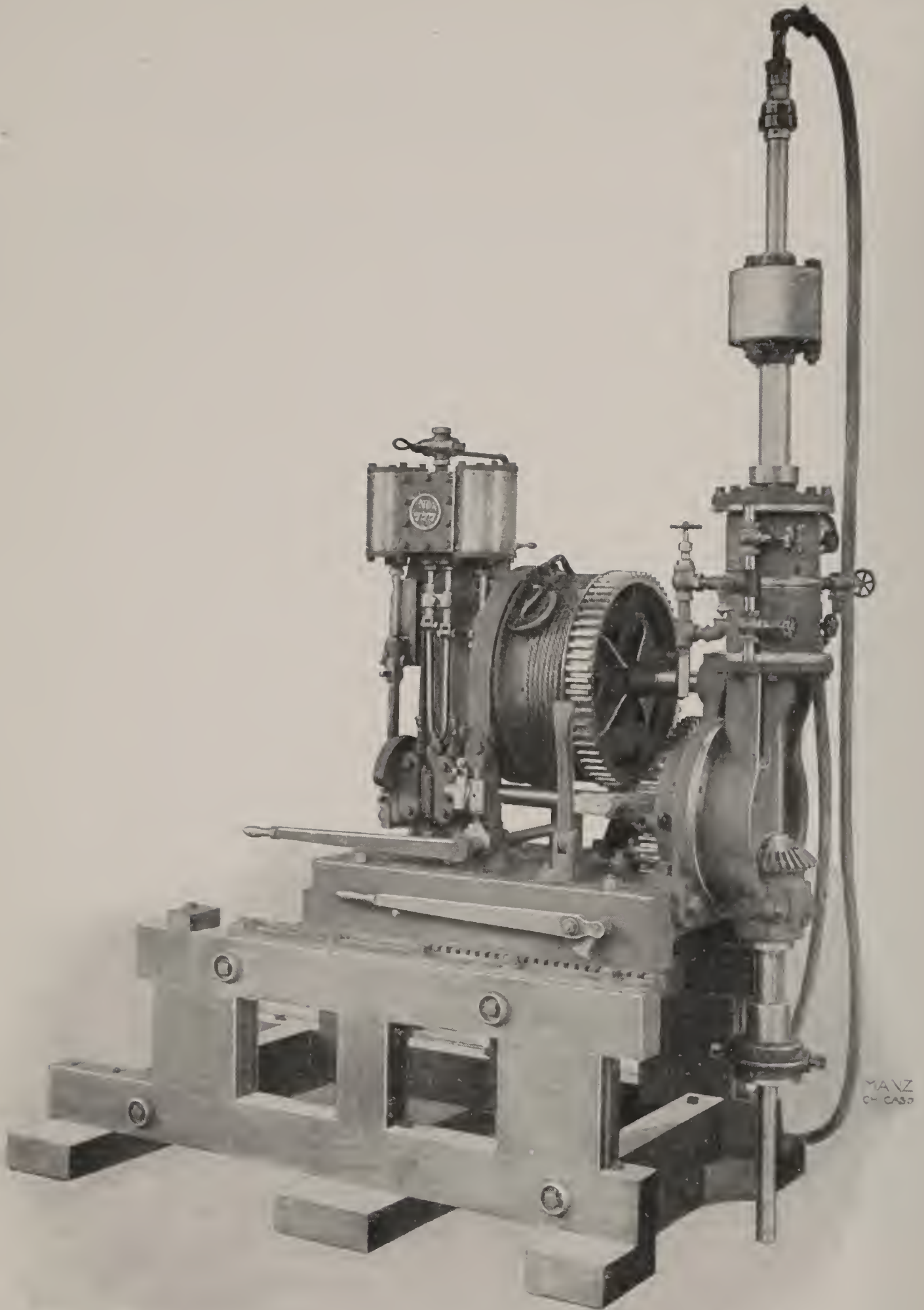


Fig. 14.

Sullivan Diamond Prospecting Core Drill, Size "C"

Capacity, 1,500 ft. depth.
Diameter of hole, $1\frac{3}{8}$ in.
Diameter of core, $1\frac{1}{8}$ in.

Sullivan Diamond Prospecting Core Drill Size "C"

This drill, in its hoisting apparatus and some other details, is modeled after the "B" Drill. It will give excellent results either in shallow holes or when called upon to work up to the extreme limit of its capacity.

Although intended principally for surface work, the "C" Drill has been frequently used at the bottom of a shaft or in a drift or stope. The "C" Drill, or the lighter "H" of similar design, when used underground enables holes to be drilled to a greater distance than is possible with the "E" Drill.

For equipment furnished with the "C" Drill and included in the price shown on page 47, see page 48.

For shipping weights and dimensions, see page 51.

Testimonial Letters: "C" Drill

Practically Required No Repairs in Two Years.

OFFICE OF THE HALL MINES, LIMITED.

Head Office: Leadenhall Buildings, 1 Leadenhall Street, London, E. C.

Telegraphic Addresses: "Claims," London; "Mineral," Nelson.

Moreing & Neals Code.

NELSON, B. C., Oct. 20, 1898.

SULLIVAN MACHINERY Co., *Chicago, Ill.*

DEAR SIR: This company used two of your Drills, size "C" and size "M," almost continuously for over two years, and I have much pleasure in testifying that the drills did their work well, practically required no repairs, and gave us entire satisfaction in every way.

Yours truly,

HENRY CROASDAILE, *General Manager.*

Diamond Drills in Mexico

COMPANIA METALLURGICA MEXICANA.

Mexico City Office, Calle de Tiburcio No. 27. Apartado Num, 307.

ROBERT S. TOWNE, President and Treasurer.

A. FOSTER HIGGINS, Vice-President.

New York Office, 27 William Street, NEW YORK, Oct. 24, 1898.

SULLIVAN MACHINERY Co., *Chicago, Ill.*

GENTLEMEN: We beg to acknowledge the receipt of your letter of Oct. 13. We have two of your Diamond Drills at different points in Mexico, each working under vastly different conditions as to the rock to be drilled, and we are pleased to state that the work done by them during the past year or more in which they have been in constant service, has been highly satisfactory.

Yours truly,

ROBERT S. TOWNE, *President.*

The Drills referred to in the above letter are "C" and "B."

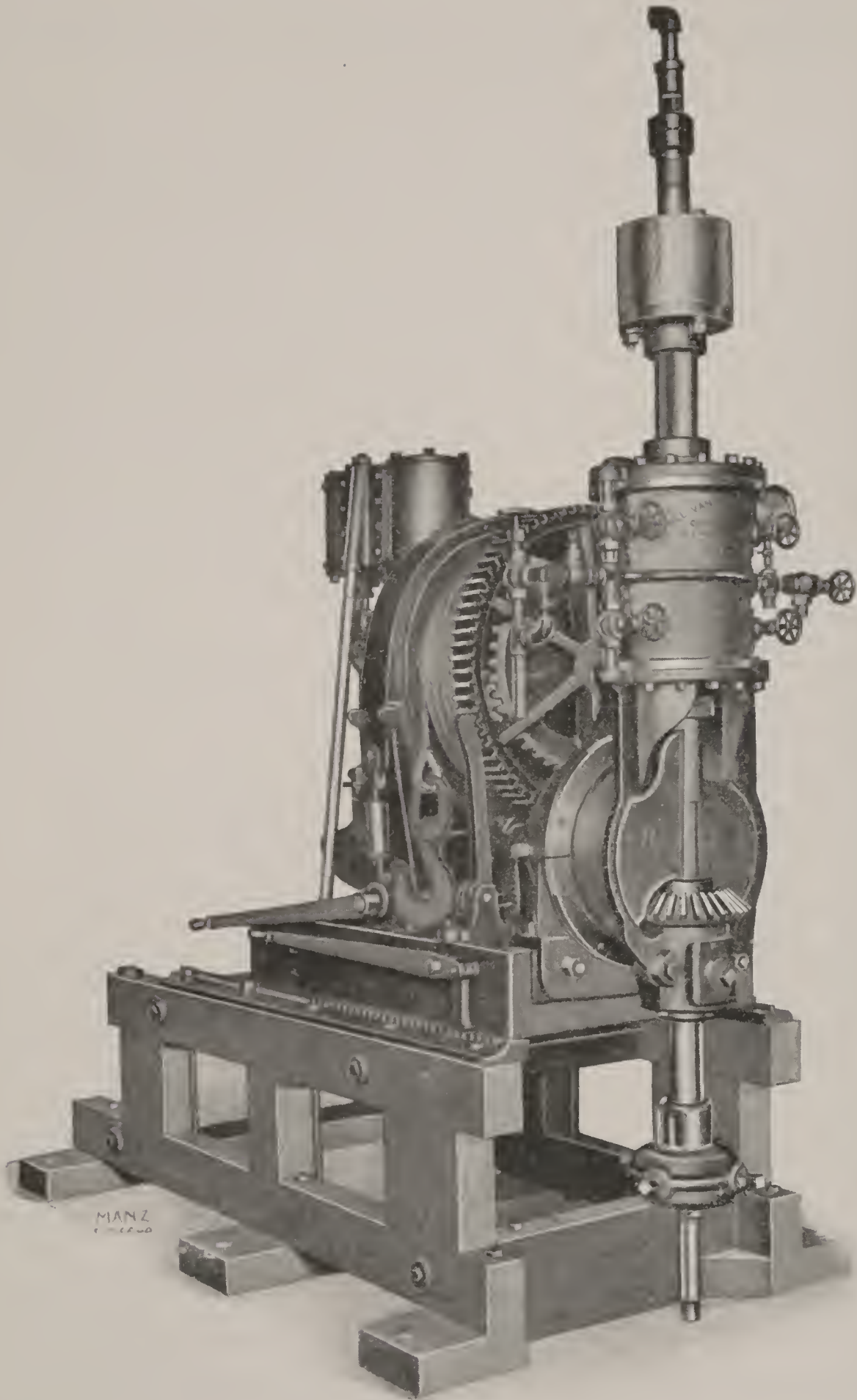


Fig. 15.

Sullivan Diamond Prospecting Core Drill, Size "B"

Capacity, 3,000 ft. depth.
Diameter of hole, $2\frac{1}{8}$ in.
Diameter of core, $1\frac{3}{8}$ in.

Sullivan Diamond Prospecting Core Drill Size "B"

The engines, hoisting rig and feed apparatus of this machine are strongly built for deep work. The hoisting gears are proportioned for a heavy weight of rods, the drum making 1 revolution to 39 of the engine; while for less depths a direct gearing in the ratio of 1 to 13 allows quick hoisting speed with light loads, one revolution of the drum winding up about six feet of the rope.

We have drilled with our "B" Drill to a depth of over 2,350 feet without counter-balancing the weight of drill-rods.

For equipment furnished with the "B" Drill, and included in price shown on page 47, see page 48.

For shipping weights and dimensions, see page 51.

Testimonial Letters: "B" Drill

Hydraulic Cylinder Drills in South Africa

THE NEW AUSTRAL COMPANY, LIMITED.

PARIS, November 11, 1898.

SULLIVAN MACHINERY CO.

DEAR SIR: Working jointly with the Rand Central Boring Syndicate, Ltd., we have used eight of the Sullivan Machinery Co.'s Diamond Drills, of the classes "B," "H" and "M" since the 15th of December, 1895, in Johannesburg, Transvaal, South Africa. Up to April, 1898—date of the last records which we have received here—we have accomplished 30,985 feet of boring with the same, and are satisfied with the results obtained. We can recommend these machines for all classes of boring work, especially in new countries. THE NEW AUSTRAL COMPANY, LTD.

Since writing the above, the New Austral Company have ordered a "P" drill.

Prospecting in Japan

mitsui & COMPANY, TOKYO, JAPAN.

TELEGRAPHIC ADDRESS, "MITSUI, TOKYO."

F. K. COPELAND, ESQ.

TOKYO, JAPAN, Nov. 8, 1898.

DEAR SIR: In reply to your inquiry in regard to the workings of the Diamond Drills we bought from your firm, I am glad to say that they have given us entire satisfaction. At first sight they appeared too light and delicate for the duty required of them, but on putting them to work I found that those were the very qualities which gave them their essential merit and superiority. They were put under men who never saw a Diamond Drill before, but from the day we started to work they gave us no trouble, and are now giving excellent results. Yours faithfully,

TAKUMA DAN.

Two "B" Diamond Drills were sold to the above firm.

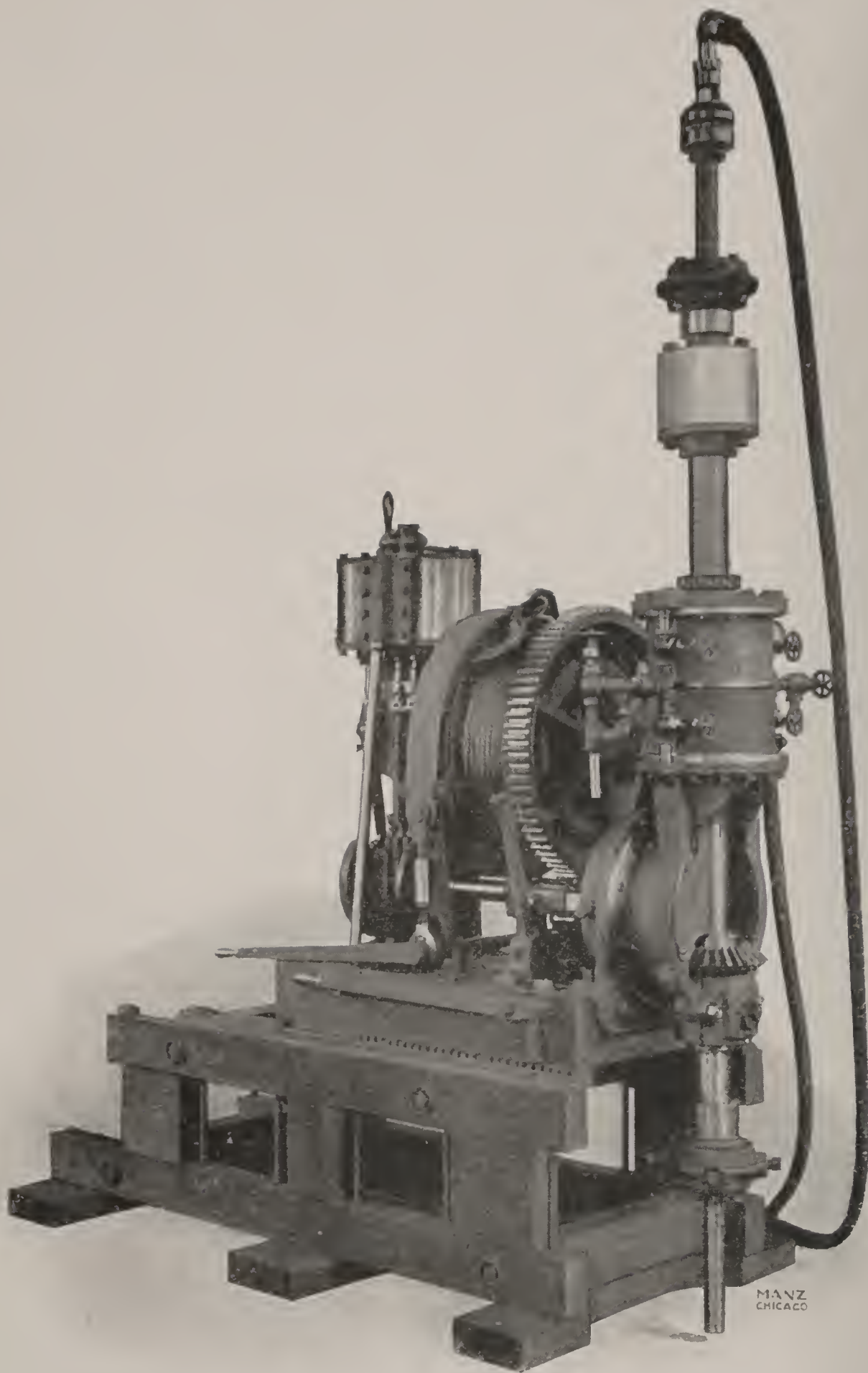


Fig. 16.

**Sullivan Diamond Prospecting Core Drill
Size "N"**

Capacity, 2,000 ft. depth.
Diameter of hole, $2\frac{1}{8}$ in.
Diameter of core, 2 in.

Sullivan Diamond Prospecting Core Drill Size "N"

The "N" Drill is arranged with extra large swivel-head, drive-rod and hydraulic cylinder for drilling a 2 13-16 inch hole, removing 2-inch core. The large size of this core makes the "N" Drill (and the "P" using the same size of fittings) especially desirable for drilling deep holes in prospecting for soft minerals, such as coal and rock salt.

Some idea of the power of this drill, and of one of the special advantages of the hydraulic feed can be gained from the fact that the hydraulic piston, 11 inches in diameter, can at any time be instantly subjected to a hydraulic pressure of at least 180 pounds per square inch, giving a total pressure of over *15,000 pounds instantly available* to raise the rods *while the drill is running*, in case of any blocking or wedging in the hole. This is a feature not possessed by other diamond drills.

For equipment furnished with the "N" Drill and included in the price shown on page 47, see page 48.

For shipping weights and dimensions, see page 51.

"N" Drills Used in Colorado

THE COLORADO FUEL AND IRON COMPANY, DENVER, COLORADO.

J. A. KEBLER, *Second Vice-President and General Manager.*

DENVER, COLO., Oct. 17, 1898.

SULLIVAN MACHINERY Co., *Chicago, Ill.*

GENTLEMEN: We have used your Diamond Drills very extensively, and under many difficult conditions. In all cases we have found them perfectly satisfactory, and I consider them by far the best Diamond Drills in the market. Yours very truly, J. A. KEBLER.

JOHN HAYS HAMMOND.

Telegraphic Address: "Oceanology, London," Bedford McNeil Code.

8, Old Jewry, LONDON, E. C., Oct. 27, 1898.

SULLIVAN MACHINERY Co.

DEAR SIR: I take pleasure in testifying to the efficiency of the Sullivan Diamond Drills, having used these drills extensively both in America and South Africa. Yours faithfully,

JOHN HAYS HAMMOND.

Sullivan Diamond Prospecting Core Drills Sizes "HN" and "CN"

These two well-known drills are built on the same lines as our "H" and "C" machines but have larger swivel heads and Hydraulic Cylinders through which the "N" size rods can pass, enabling them to use the same size fittings as our "N" model.

In many cases it is of great advantage to secure a large core from the drillings; this is true in prospecting for coal, for which work these machines are especially recommended, as they drill to a sufficient depth for all ordinary work in this line and will remove a core two inches in diameter.

In every case we recommend using drill rods and fittings of the same size. This gives more satisfactory results and prevents the annoying vibration of the rods which is liable to occur when small rods are used in connection with large size fittings.

Capacity "H N," 500 ft. depth.

Capacity "C N," 800 ft. depth.

For equipment furnished with the "H N" and "C N" Drills, and included in price shown on page 47, see page 48.

For shipping weights and dimensions, see page 51.

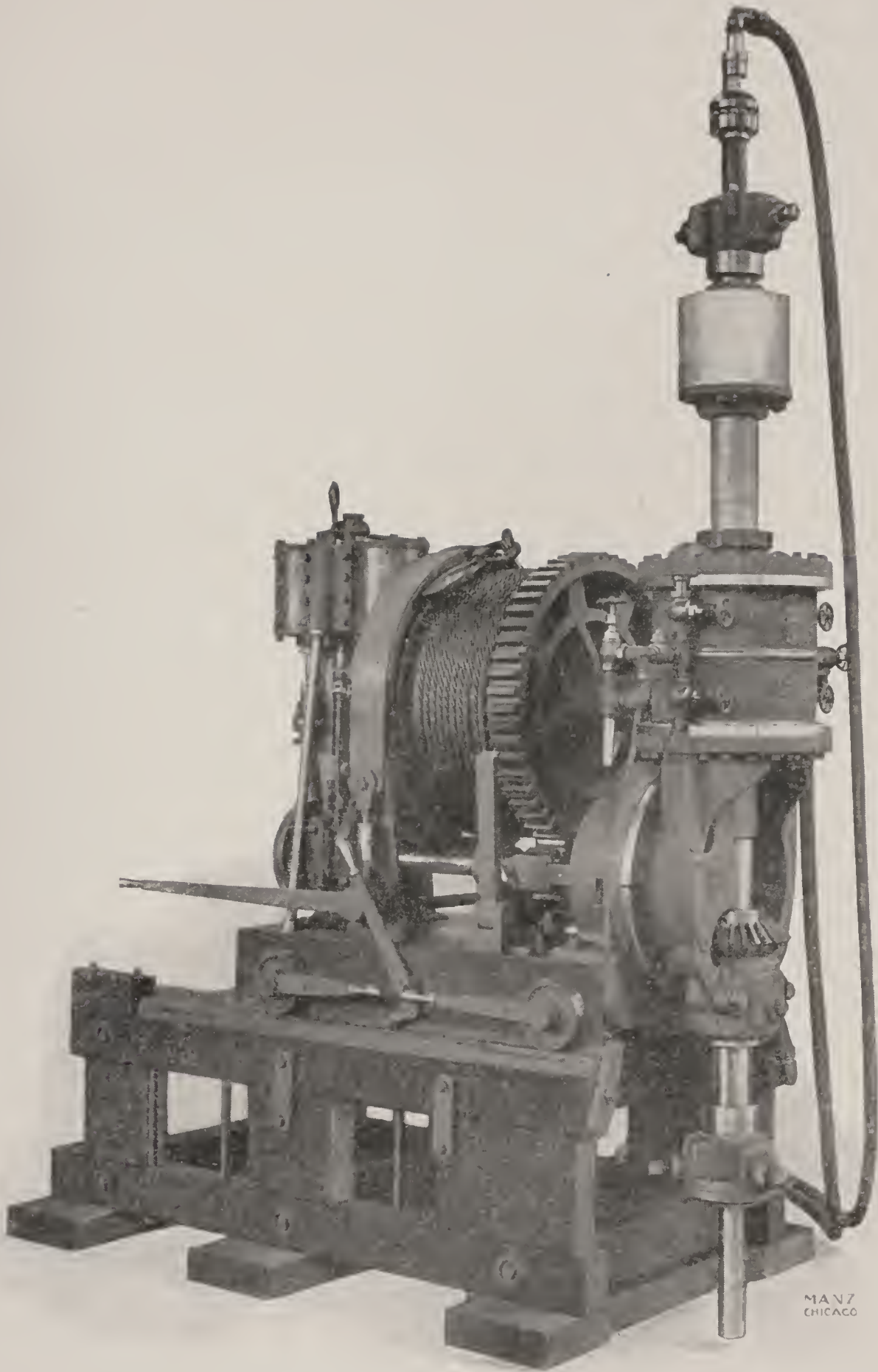


Fig. 17.

**Sullivan Diamond Prospecting Core Drill
Size "P"**

Capacity, 4,000 ft. depth.
Diameter of hole, $2\frac{3}{8}$ in.
Diameter of core, 2 in.

Sullivan Diamond Prospecting Core Drill Size "P"

The engines of the "P" are similar to those of the "B" and other smaller drills, but much more powerful. Its hoisting arrangement is very complete and a hoisting speed can be used, adapted always to the weight of rods to be raised, thus saving considerable time in hoisting from a great depth; for the different combinations can be thrown in or out in a few seconds, and several speeds used during one pull. As this drill on its base-plate is too heavy to be easily slid back and forth on the frame, a special device has been made use of for this purpose. There are two axles passing through the base-plate, with wheels at their ends, and hand-levers keyed to the axles. With the levers in the position shown in the cut, the wheels are raised off the frame, and the base-plate clamped down to it. Raising the levers to a vertical position loosens the clamps by means of cams on the axle, and at the same time lowers the wheels to the track and raises the base-plate to rest on the axle and wheels. The drill can then be rolled back on the frame. Reversing the former operation clamps it again to the frame. Thus in spite of the weight of so powerful a machine, the work of moving it back and forth is done very quickly and easily, with no danger of disturbing the setting of the machine. The hydraulic cylinder of this machine, with 180 pounds pump pressure, gives a total available upward or downward pressure of over 27,000 pounds.

For equipment furnished with the "P" Drill and included in the price shown on page 47, see page 48.

For shipping weights and dimensions, see page 51.

"P" Drill in British Columbia

THE NEW VANCOUVER COAL MINING AND LAND COMPANY,
LIMITED.

NANAIMO, B. C., Oct. 18, 1898.

MESSRS. THE SULLIVAN MACHINERY Co., *Chicago, Ill.*

GENTLEMEN: I have very great pleasure, indeed, in testifying to the splendid work done by your machines during many years of almost constant work.

We have been boring almost entirely in search of coal, and the strata overlying the coal measures are of a very varied character. We have shales, sandstones and conglomerates, some of the latter being most difficult to penetrate, so that there have been scarcely any conditions in boring in which your machines have not been subjected to severe tests in our exploratory work during the last twelve years.

The depth of our bore-holes ranges from 500 to 2,000 feet. We have mostly used your size "P" machine. I am, gentlemen,

Yours truly,

SAMUEL M. ROBINS, *Superintendent.*

Sullivan Diamond Prospecting Core Drill Size "PK"

Owing to the demand for a prospecting drill of a size intermediate between the "P" and "K" drills we have designed the "P K," which is built along the same lines as our well known "P" drill.

All portions of the machine were designed with the view of removing unnecessary weight and still have the machine capable of easily performing the heavy duty required of it. As a result this drill is much lighter than the "K" type, and consequently more easily handled while being transported from one point to another.

This drill can be used to bore a hole of from 6-in. to 6½-in. diameter and 1,000 feet deep.

For deeper work smaller fittings must necessarily be used on account of the great weight of the rods.

The rods in the regular equipment are of four sizes, the largest at the surface drilling a 3¾-in. hole, extending to a depth of 1,000 feet, and capable of removing a 2¾-in. core; the next smaller size drills a 3½-in. hole and extends from 1,000 to 2,000 feet, removing a 2³/₁₆-in. core.

From 2,000 to 3,000 feet the third size rods are used, boring a 2 13-16-in. hole and cutting a 2-in. core; at 3,000 feet the smallest size rods are used, drilling to the extreme depth of 5,000 feet, boring a 2 1-16-in. hole and removing a core 1¾-in. in diameter.

Even with this arrangement the weight of the rods is very great, but is handled by the hoisting arrangement with which this machine is equipped, with perfect safety and without loss of time.

For equipment furnished with the "P K" drill and included in the price shown on page 47, see page 48.

For shipping weights, see page 52.

Sullivan Diamond Prospecting Core Drill Size "K"

Capacity, 6,000 feet.

Diameter of hole to 1,000 feet deep, $3\frac{3}{4}$ in. Diameter of core, $2\frac{3}{4}$ in.

Diameter of hole for 1,000 to 3,500 ft., $3\frac{1}{8}$ in. Diameter of core, $2\frac{3}{8}$ in.

Diameter of hole for 3,500 to 6,000 ft., $2\frac{1}{8}$ in. Diameter of core, 2 in.

This drill is designed for much deeper prospecting work than has ever before been attempted in this country. A line of drill rods a mile long and of uniform section would pull apart of its own weight; this difficulty has been overcome by successively reducing the size of the drill rods as the depth of the hole increases, thus distributing the strain and approximating the result that would be attained were a taper rod practicable; even with this provision the weight of the full column of rods, 6,000 feet in length, is approximately twenty tons.

To successfully handle this weight it was necessary to make the machine itself very strong and heavy, and with a convenient and well designed hoisting arrangement. The hoist on this Drill is as perfect as is found on the best designed mine hoists. The engines are provided with link motion, enabling the lowering of the rods into the hole under steam pressure, and avoiding the risk of the friction brake failing to act. The engines are strong and of the same type as in our other hydraulic-fed Drills. Elaborate care has been taken to counterbalance the great weight of the drill rods.

This drill has the famous Sullivan hydraulic feed. The hydraulic cylinder gives an available pressure of 60,000 pounds, which can be utilized for raising the rods in case of wedging or blocking. It is proportioned to handle the enormous weight of the line of rods with ease and safety. The feed is under absolute control, so that the pressure on the bit can be regulated with the utmost nicety to the varying conditions of the formation penetrated; without this hydraulic feed it would be impossible to handle this weight without great danger of destroying the diamonds in the bit.

In a drill of this large size it is desirable to have two duplex pumps, one for operating the hydraulic cylinder and the other to force water through the rods; by each working independently of the other, the liability to accident is reduced to a minimum.

For equipment furnished with the "K" Drill and included in price shown on page 47, see page 48.

For shipping weights, see page 52.



Fig. 18. Electric Drill at work in Smuggler Mine, Aspen, Colo.

Sullivan Diamond Prospecting Core Drills Operated by Electricity

The increasing employment of electricity in mining operations has opened a new field for the Diamond Prospecting Drill. One of the difficulties in the way of the use of the Diamond Drill underground, and in rough, mountainous localities, has been to get power to the machine, as the nature of the surface of the country may make it impracticable to get heavy boilers and machinery close to the mine opening. Even where this can be done, there still remains the great difficulty and expense of getting fuel to the boilers, if the mine opening is located, as often happens, on a steep declivity where timber is scarce; and a further difficulty arises where compressed air is not used as a motive power, from the fact that the use of steam underground, besides being unsatisfactory for power and uncomfortable for the men, is often a source of great expense, owing to damage caused by the action of the exhaust steam on the mine timber and rock.

To overcome the above mentioned objections to the use of a steam-driven or air-driven Diamond Drill, we have designed the "R," "R S" and "R H" Drills, which will permit core drilling to be undertaken to advantage in places where it has hitherto been impracticable. The dynamo can be located near an engine or water wheel at any distance and the power carried easily and inexpensively to the drill, which can be on the mountain-top, in a deep shaft or in any part of the mine.

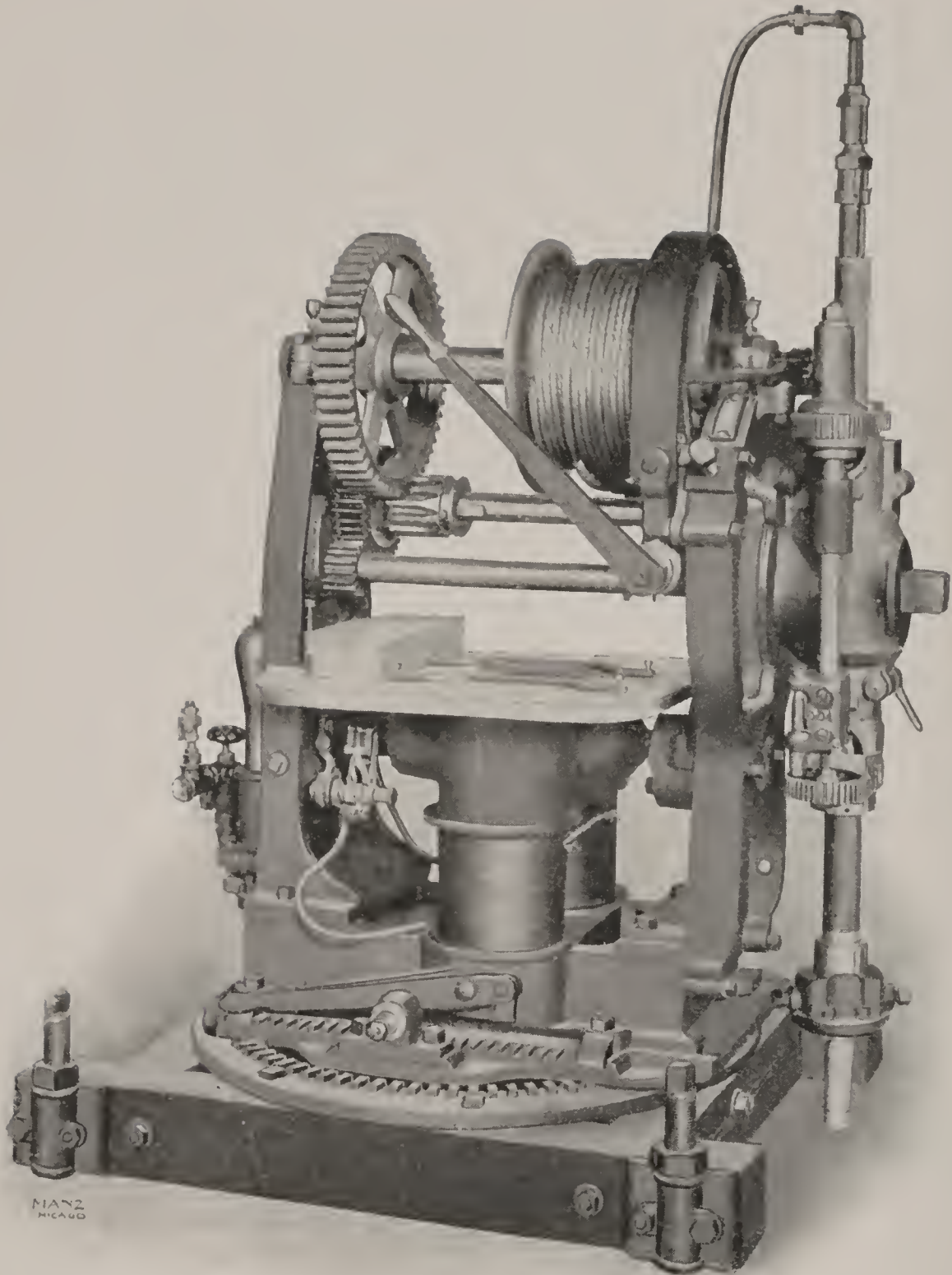


Fig. 19.

**Sullivan Diamond Prospecting Core Drill
Size "R" (Electric)**

Capacity, 300 ft. depth.
Diameter of hole, $1\frac{9}{16}$ in.
Diameter of core, $\frac{1}{8}$ in.

Sullivan Diamond Prospecting Core Drill Size "R" (Electric)

The "R" Drill is a very neat and compact machine for drilling to a depth of 300 feet, using electricity as a motive power. The motor for driving the drill is mounted on the same frame with the pump and hoisting drum, so that the drill, motor and hoisting rig are part of the machine, which can be mounted on trucks for moving about the mine. The frame is provided with a swivel base, permitting holes to be drilled in any direction, as well as at any angle, without moving the machine.

The friction feed, described on page 11, is used with this drill. Switches, etc., are provided for safety and convenience, and in order that the machine may be used in very wet mines, if necessary, great care is taken to insulate all parts likely to cause a ground connection.

We carry "R" Drills in stock wound for 110, 220 and 550 volt currents; drills wound for other voltage can be furnished on short notice.

For equipment furnished with the "R" Drill, and included in the price shown on page 47, see page 49.

For shipping weights and dimensions, see page 52.

Testimonial Letter: "R" Drill

THE ASPEN MINING & SMELTING CO.

ASPEN, COLO., Dec. 19, 1892.

MR. T. L. DEE, THE SULLIVAN MACHINERY CO., *Chicago, Ill.*

DEAR SIR: Replying to your favor of the 12th inst.

First—We are using one (R) electric drill.

Second—Approximate total number of feet drilled, 16,000.

Third—Nature of rock, limestone, generally compact, but containing fractured and seamy zones.

Fourth—Seven thousand feet drilled in 1892, at the rate of 38½ feet per 24 hours, two shifts.

Fifth—Cost per foot in 1891, 81 cents; in 1892, 68 cents, including carbon losses, etc.

Sixth—Advantages derived, cheap and effective prospecting, rapid work, discoveries of ore, convenient and economical application of power, etc.

Seventh—Several discoveries of mineral have been made, aggregating about \$50,000 in value.

Yours very truly,

FRED G. BUCKLEY, *General Manager.*

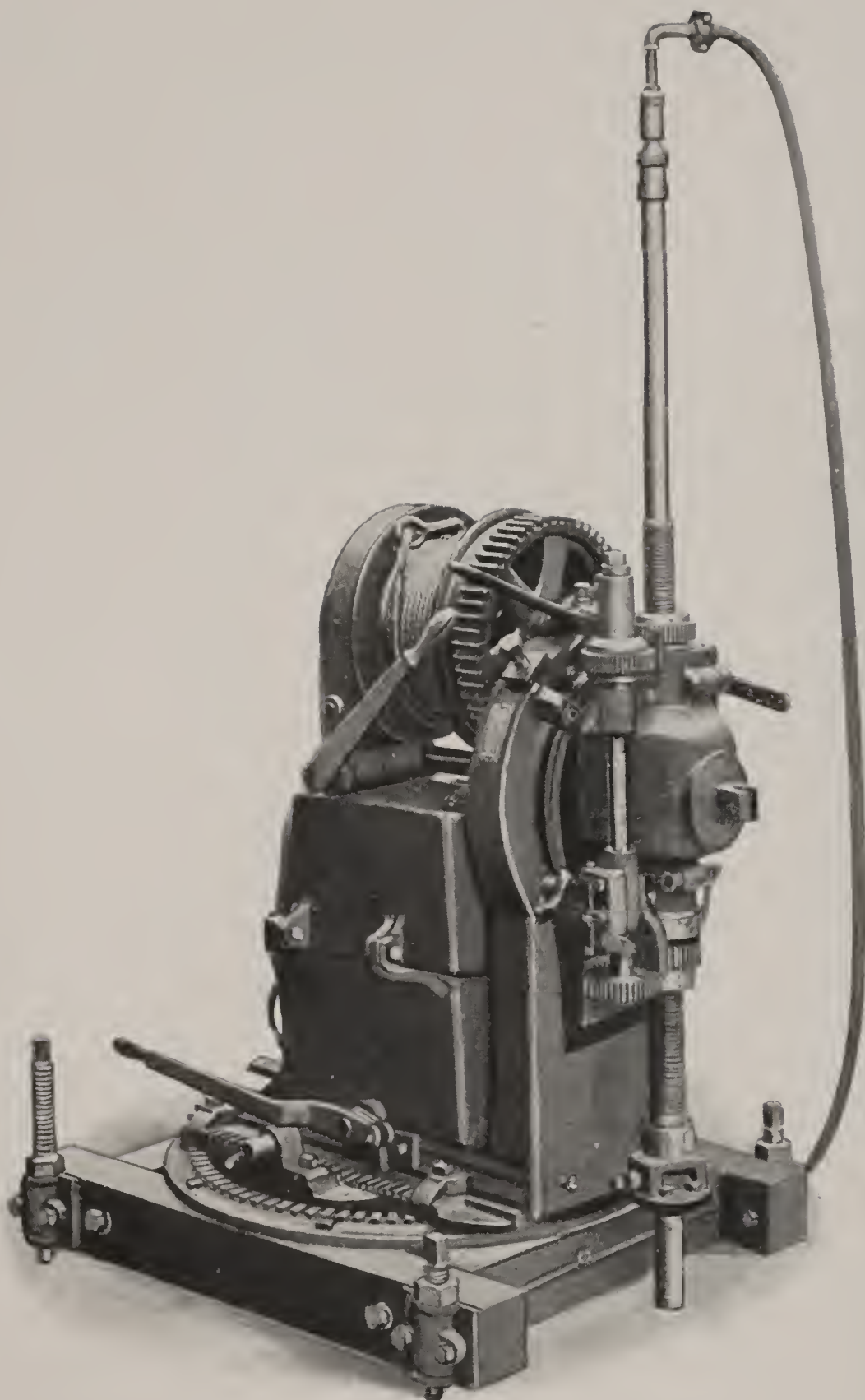


Fig. 20. Front view.

**Sullivan Diamond Prospecting Core Drill
Size "RS" (Electric)**

Capacity, 500 ft. depth.

Diameter of hole, $1\frac{9}{16}$ in.

Diameter of core, $\frac{15}{16}$ in.

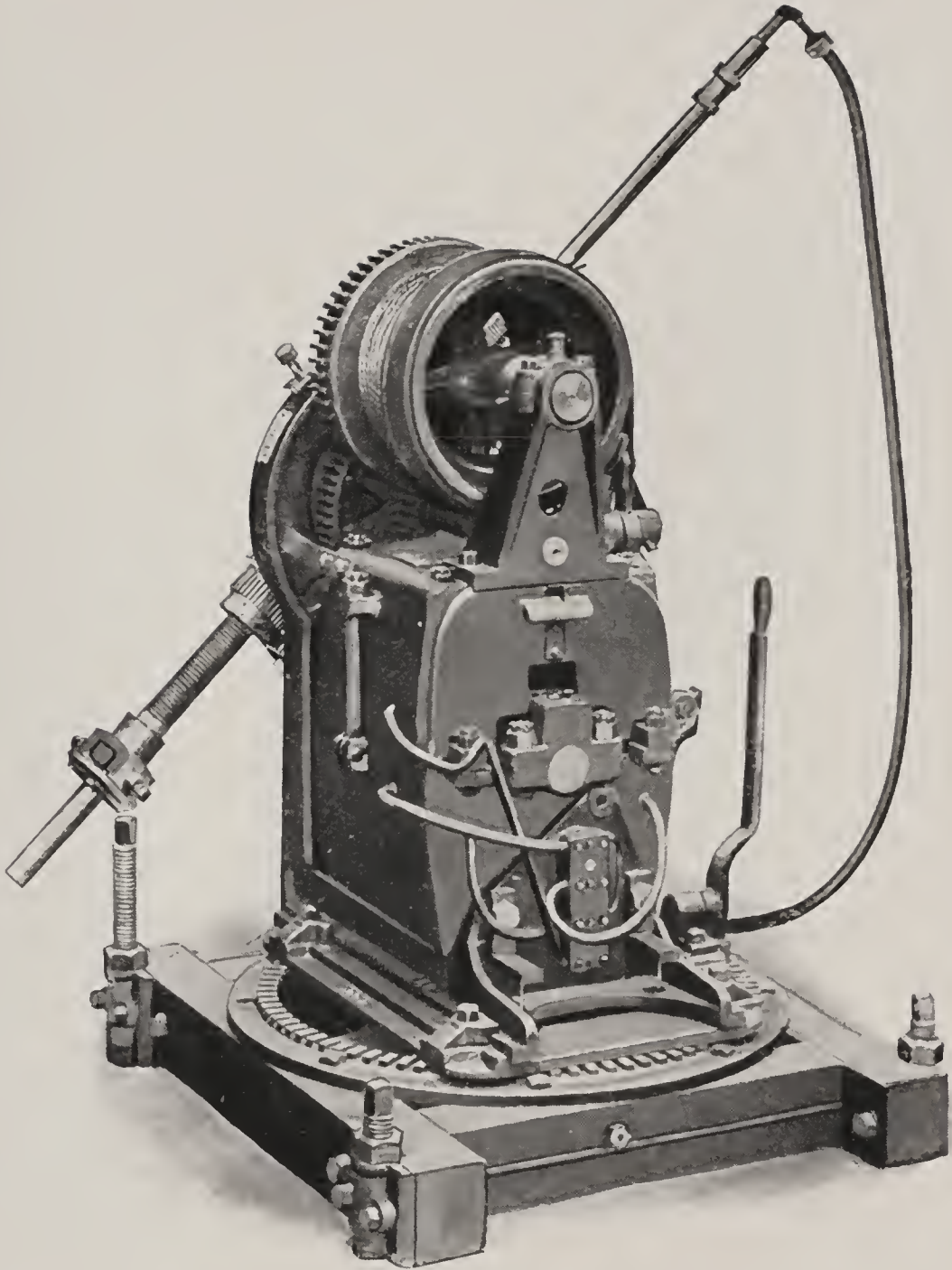


Fig. 21. Rear view.

**Sullivan Diamond Prospecting Core Drill
Size "RS" (Electric)**

Capacity, 500 ft. depth.

Diameter of hole, $1\frac{9}{8}$ in.

Diameter of core, $\frac{15}{8}$ in.

Sullivan Diamond Prospecting Core Drill Size "RS" (Electric)

The motor for driving the "RS" Drill is mounted on the same base as the drill proper and hoisting drum, so that the whole machine, with the exception of the pump, which is on a separate base, can be mounted on trucks for moving about the mine. As in the smaller size electric drill, the frame of the "RS" is provided with swivel base, permitting holes to be drilled in any direction as well as at any angle, without moving the machine.

The friction feed used with this drill is described on page 11. Switches, etc., are provided with the machine, and all parts likely to cause a ground connection when the drill is used in very wet mines, are carefully insulated.

We have "RS" Drills in stock, wound for 110, 220 and 550 volt currents, and can furnish machines wound for other voltage on short notice.

For equipment furnished with the "RS" Drills, and included in price shown on page 47, see page 49.

For shipping weights and dimensions, see page 52.

Testimonial Letter: Electric Drill

GENERAL OFFICES OF
THE DURANT MINING CO.
THE COMPROMISE MINING CO.
THE CONOMARA MINE.

THE LATE ACQUISITION CONS. MINING CO.
THE ASPEN SAMPLING CO.
THE SMUGGLER CONCENTRATOR.
THE SMUGGLER MINING CO.

ASPEN, COLO., Oct. 31, 1898.

F. K. COPELAND, ESQ., *President Sullivan Machinery Co., Chicago, Ill.*

GENTLEMEN: We have been using your Diamond Drill, worked by electric power, for a number of years, and we have found that for the purposes for which we used it—that of cross-cutting a very wide vein—it is very valuable. Your Drill has done a great many thousand feet of work for us, and has done it very satisfactorily, and has been of great benefit to us with but a small outlay for repairs. In soft ground, or what is called "ravelly ground," we find that it is not advisable to make to exceed twenty-five feet per shift, whereas in hard ground where there is no trouble about the core crumbling we have made as high as fifty-five feet in seven hours.

Very truly yours,

S. I. HALLETT, *Superintendent.*

Note: See illustration on page 39.

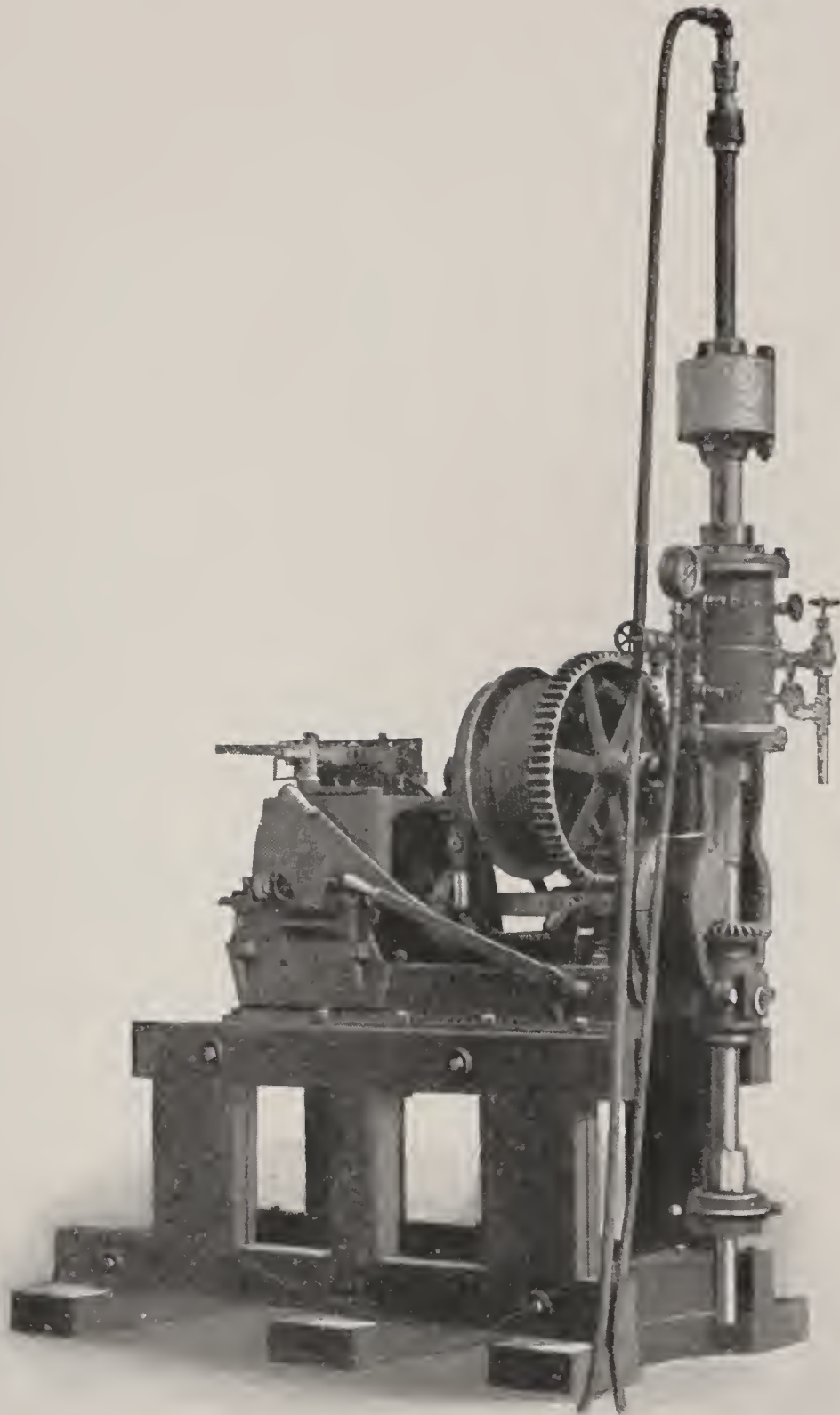


Fig. 22.

Sullivan Diamond Prospecting Core Drill Size "RH" (Electric)

Finding that the "R" and "RS" Drills filled a long-felt want for electric core drilling machines, and met with great success when placed on the market, we decided to present to the public another electric core drill of greater capacity than the others, and therefore designed and built the "RH" capable of drilling to a depth of 1,000 feet.

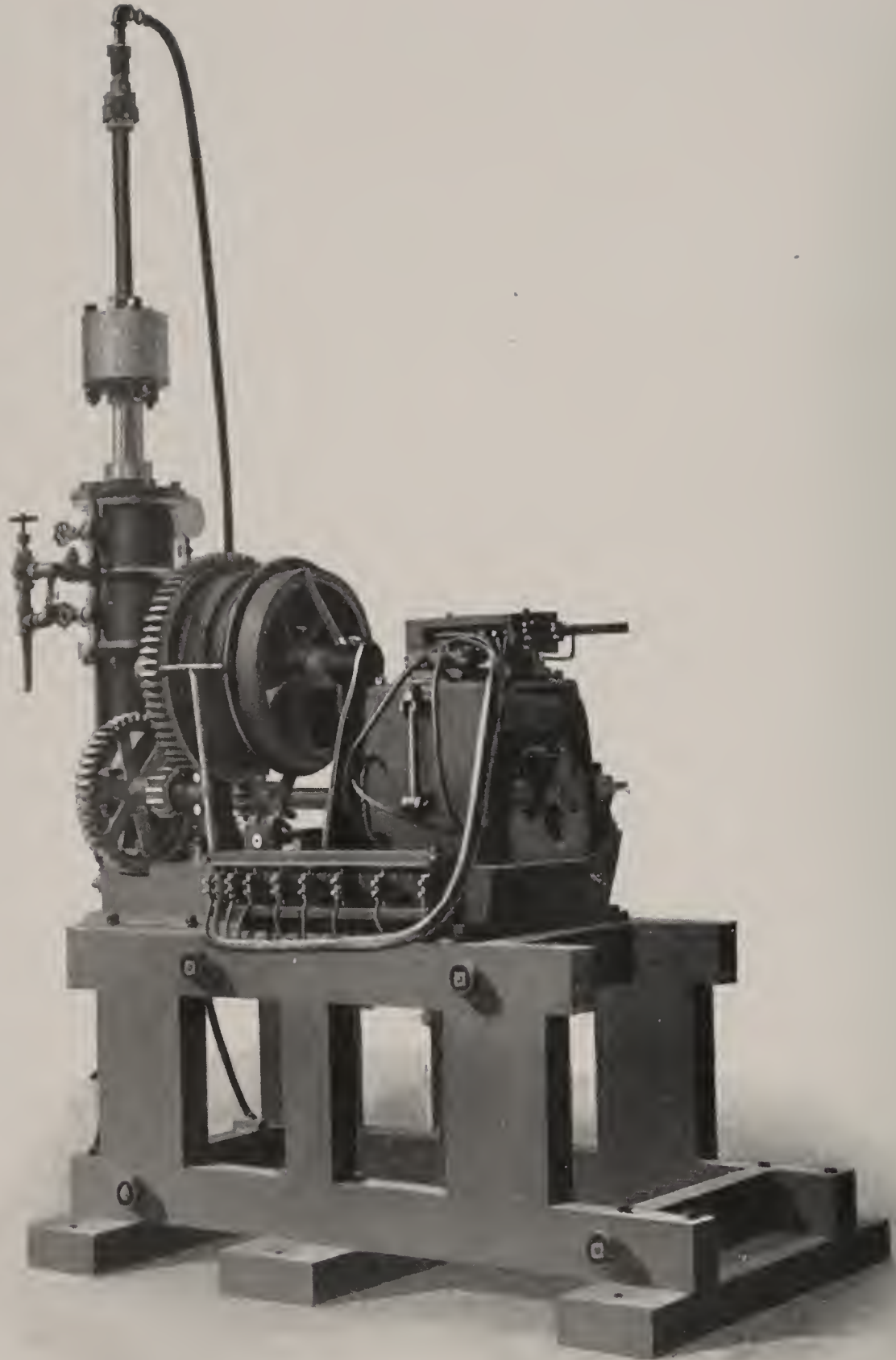


Fig. 23.

Size "RH" (Electric, Rear View)

This drill is fitted with our single cylinder hydraulic feed, and is modeled on the same lines as our standard "H" drill.

The economy, convenient application of power and ease of operation of this new drill make it one of our most successful models.

For equipment furnished with the "RH" Drill, and included in price shown on page 47, see page 48.

For shipping weights and dimensions, see page 52.

Table of Sizes, Capacities, Dimensions and Other Data of Sullivan Diamond Prospecting Core Drills

Size of Drill	Capacity		Diameter of Core, Inches	Steam Pipe, Inches	Exhaust Pipe, Inches	Pump Required	H.P. Boiler Required for Drill and Pump	Space Required.		Price with Equipment, Per Pages 46 and 47	Code Word
	Depth of Hole, Feet	Diameter of Hole, Inches						Drive Rod in Lowest Position	Height		
M	300	1 ⁹ / ₁₆	1 ⁵ / ₁₆	Hand	1 ¹ / ₄	Power 4 ¹ / ₂ x 2 ³ / ₄ x 4	Drill 8	.....	.....	\$ 350	Abbuindo
E	400	1 ⁹ / ₁₆	1 ⁵ / ₁₆	1	1 ¹ / ₄	4 ¹ / ₂ x 2 ³ / ₄ x 4	8	.....	.....	700	Abbrivida
S	500	1 ⁹ / ₁₆	1 ⁵ / ₁₆	1	1 ¹ / ₂	4 ¹ / ₂ x 2 ³ / ₄ x 4	10	.....	4' 3"	1100	Abdachen
H	1000	1 ¹³ / ₁₆	1 ¹ / ₈	1	1 ¹ / ₂	4 ¹ / ₂ x 2 ³ / ₄ x 4	10	.....	6' 6"	1800	Abbruniva
HG	1000	1 ¹³ / ₁₆	1 ¹ / ₈	1	1 ¹ / ₂	4 ¹ / ₂ x 2 ³ / ₄ x 4	12	.....	6' 6"	1700 1800	Abbrix
C	1500	1 ¹³ / ₁₆	1 ¹ / ₈	1	1 ¹ / ₂	6 x 4 x 6	12	.....	6' 9"	2400	Abbriglio
B	3000	2 ¹ / ₁₆	1 ³ / ₈	1 ¹ / ₄	2	6 x 4 x 6	15	.....	7' 6"	2850	Abbranchi
N	2000	2 ¹³ / ₁₆	2	1 ¹ / ₄	2	7 ¹ / ₂ x 4 ¹ / ₂ x 6	20	.....	7' 6"	3300	Abbuarono
HN	500	2 ¹³ / ₁₆	2	1 ¹ / ₄	2	6 x 4 x 6	10	.....	6' 6"	2000	Abbivon
CN	800	2 ¹³ / ₁₆	2	1 ¹ / ₄	2	6 x 4 x 6	10	.....	6' 9"	2700	Abbvicious
P	4000	2 ¹³ / ₁₆	2	1 ¹ / ₄	2	7 ¹ / ₂ x 4 ¹ / ₂ x 10	25	.....	10' 6"	4000	Abbuiaasi
PK	5000	2 ¹ / ₁₆	1 ³ / ₈	1 ¹ / ₄	2	8 x 4 x 12	30	.....	.....	6000	Abbruse
K	6000	2 ¹³ / ₁₆	2	1 ¹ / ₂	2 ¹ / ₂	{ 8 x 4 x 12 6 x 4 x 6	40	.....	.....	9000	Abbruscalo
R	300	1 ⁹ / ₁₆	1 ⁵ / ₁₆	Electric Motor	Electric Motor	Attached	.....	.....	.....	1500	Abburatta
RS	500	1 ⁹ / ₁₆	1 ⁵ / ₁₆	Electric Motor	Electric Motor	{ 3x3 Triplex Electric	.....	.....	.....	1800	Abcedasse
RH	1000	1 ¹³ / ₁₆	1 ¹ / ₈	Electric Motor	Electric Motor	{ 3x3 Triplex Electric	.....	.....	.....	2000	Abburx

N. B.—Add \$125 for mounting on wheels drills of sizes up to and including "N" drill. Add \$200 additional for mounting "P" drill. It should be borne in mind: 1. Holes can be increased in diameter to any desired size by using a Reaming Bit. Also, by using a larger core-barrel, lifter and bit, a larger hole can be drilled and a larger core obtained than that given in column three.

2. Prices above are net f. o. b. Chicago, Ill., Claremont, N. H., or New York unless otherwise stated. An extra charge is made for packing for export, or any other unusual shipping expense.

3. For extra equipment, see pages 48 and 49.

4. For complete drill estimates, see pages 56 to 68.

Equipment Tables

The following equipment is furnished with the "R H," "H," "H G," "C," "B," "H N," "C N," "N," "P," "P K" and "K" Drills without extra charge at prices shown on page 47.

- | | |
|--|---|
| <ul style="list-style-type: none"> 2 Blank Bits ready to set. 205 feet of Drill Rods with Couplings (20 10-ft., 1 5-ft.). 1 ten-foot Core Barrel. 2 Core Lifters. 1 Core Shell. 25 feet 4-ply Water-hose with Connection, for Drill Rods. 12 feet 4-ply Water-hose with Connection, to connect Drill and Pump. 10 feet 6-ply Steam-hose with Connection, for Drill (5-ply for C and H). 5 feet 2-ply Drip-hose. 1 Swivel Steam Connection for Engine. 1 Wire Rope (wound on Hoisting Drum) with Hook. With "C" and "H," 75 feet of 1/2-in. rope; with "B" and "N," 100 feet of 5/8-in. rope; with "P," 150 feet of 7/8-in. rope; with "P K" and "K," 155 feet of 1 1/4-in. rope. 1 Drive Chuck. 1 Safety Clamp. 2 Sheaves for Hoisting Rods, with straps and hooks. 1 Lifting Bail with Clevis. 1 Bail and Bolt for Sheave. 1 Lifting Swivel or Hoisting Plug, with Coupling. 1 Water Swivel with Coupling and Elbow. 1 Pressure Gauge for Feed Cylinder. | <ul style="list-style-type: none"> 1 Tool Chest with Lock and Key. 1 complete set of Diamond-Setting Tools, consisting of: <ul style="list-style-type: none"> 1 3 1/4-in. Jaw Vise, with swiveled base. 1 Breast-Drill with 5 bits from 1/8 to 1/4 in. diam. 1 set of 12 Setting Chisels and Punches. 1 light Hammer for diamond setting. 1 pair each, 6-in. Dividers, Inside and Outside Calipers. 1 Head for holding Bits while setting. 1 Machinist's Hammer. 1 Screw Driver. 1 Draw Bolt for gears. 1 Copper Strainer and Union. 1 6-in. Adjustable Level. 2 pairs Pipe-Tongs. 1 14-inch Pipe-Wrench. 2 12-inch Monkey Wrenches. 1 complete set of Solid Wrenches for Engine, Chuck, etc. 1 Hand Oiler. 1 1-gallon Oil Can. 1 Engine Oil Cup with Valve. 2 Recovering Taps. Rubber and Hemp Packing and Waste. All Pipe and Fittings necessary to connect Drill, Pump and Boiler. |
|--|---|

(See next page for regular equipment for smaller drills.)

Equipment Tables

The following equipment is furnished with the sizes "E" and "S," without extra charge at prices shown on page 47. This same equipment is also furnished with the "R" and "R S" Drills, with additions as per note below:

<ul style="list-style-type: none"> 2 Blank Bits ready to set. 200 feet of Drill Rods with Couplings (39 5-ft., 5 1-ft.). 1 5-foot Core-Barrel. 1 Core Shell, and two core lifters. 17 feet of 1-in. 4-ply Steam-hose. 17 feet of ¾-in. 2-ply Water-hose. 1 Water Swivel with coupling. 1 Lifting Swivel with coupling. 1 Drive Chuck. 1 Safety Clamp. 1 extra set of Feed Gears. 1 extra Friction Spring. 1 Pressure Gauge. 1 Tool Chest with Lock and Key. 1 Complete set of Diamond-Setting Tools, consisting of: <ul style="list-style-type: none"> 1 3¾-in. Jaw Vise with swiveled base. 1 Breast-Drill, with 5 bits from ⅛ to ¼ in. diameter. 1 set of 12 Setting Chisels and Punches. 	<ul style="list-style-type: none"> 1 light Hammer for diamond setting. 1 pair each, 6-in. Dividers, Inside and Outside Calipers. 1 Head for holding bits. 1 Machinist's Hammer. 1 6-in. Adjustable Level. 1 pair Pipe-Tongs. 2 14-in. Pipe-Wrenches. 2 10-in. Monkey Wrenches. 1 complete set of solid Wrenches for engine, etc. 1 13-inch Sheave Wheel with strap and hook. 1 Hand Oiler. 1 half-gallon Oil Can. 1 Engine Oil Cup. 2 Recovering Taps. Rubber and Hemp Packing, and Waste. Valves and Fittings ready to connect to supply of steam or compressed air.
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Note: The equipment furnished with the DIAMOND PROSPECTING DRILLS "R", "R S" and "R H" includes also motor, carbon brushes, switch, and extra fuses, but does not include speed controllers, steam hose, or swivel connection. With the "R" Drill a pump, attached to the drill frame, is included in the equipment.

The following equipment is furnished with the "M" (hand-power) without extra charge at prices shown on page 47:

<ul style="list-style-type: none"> 2 Blanks Bits ready to set. 1 set of 12 Chisels and Punches for diamond setting. 1 Head for holding bits while setting. 100 feet of Drill Rods with Couplings (9 10-ft., 1 5-ft., 3 20-in.). 1 Lever Hand Pump. 1 10-foot Core-Barrel. 1 20-in. Core-Barrel. 1 Core-Shell and 2 Lifters. 12 feet of 1-in. 4-ply Suction-hose with connection and strainer. 10 feet of ½-in. 2-ply Water-hose. 1 Water Swivel. 	<ul style="list-style-type: none"> 1 Lifting Swivel. 1 Coupling, Drive Spindle to Rods. 1 Safety Clamp. 1 complete set of Feed Gears (3 pairs). 1 Tool Box with Lock and Key. 2 pairs Pipe Tongs. 1 14-in. Pipe-Wrench. 1 10-in. Monkey-Wrench. 1 complete set of Solid Wrenches. 1 Hand Oil Can. 1 half-gallon Oil Can. 2 Hand Cranks. 1 13-in. Sheave Wheel with strap and hook.
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Ocean Shipping Weights and Dimensions of Sullivan Diamond Prospecting Core Drills With Regular Equipment

“M” DRILL.

Weight of Drill complete.....	639 lbs.
“ Equipment, page 49.....	712 “
	1351 lbs.

In 4 boxes, occupying about 41 cubic feet.
Weight of Rods, boxed, with Couplings, per 100 ft..... 420 “

Boiler not needed for Hand-Power Drill. Lever Hand-Pump included in Equipment.

“E” DRILL.

Weight of “E” Drill complete.....	580 lbs.
“ Equipment, page 49.....	1454 “
	2034 lbs.

In 7 boxes, occupying about 46 cubic feet.
Weight of Rods, boxed, with Couplings, per 100 ft..... 420 lbs.
“ 8 H. P. Boiler on Wheels..... 4900 “
“ 4½x2¾x4 Special Pump..... 300 “

NOTE.—The heaviest piece of “E” Drill weighs only 125 lbs., and no other piece over 75 lbs.

“S” DRILL.

Weight of “S” Drill complete.....	1095 lbs.
“ Equipment, page 49.....	1511 “
	2606 lbs.

In 6 boxes, occupying about 73 cubic feet. Weight of Rods, Boiler and Pump same as “E” Drill.

“H G” AND “H” DRILLS.

Weight of Drill <i>without</i> Swivel-Head.....	1177 lbs.
“ Swivel-Head boxed separately.....	427 “
“ Frame	407 “
“ Equipment, page 48.....	1986 “
	3997 lbs.

In 9 boxes, occupying, with Frame, about 137 cubic feet.
Weight of Rods, boxed, with Couplings, per 100 ft..... 460 lbs.
“ 10 H. P. Boiler on Wheels..... 6025 “
“ 4½x2¾x4 Special Pump..... 300 “

Ocean Shipping Weights, Etc., Continued

"C" DRILL.

Weight of Drill <i>without</i> Swivel Head.....	1678 lbs.
" Swivel-Head boxed separately.....	449 "
" Frame	429 "
" Equipment, page 48.....	2000 "
<hr/>	
Total Weight, Drill and Equipment.....	4556 lbs.
In 9 boxes, occupying, with Frame, about 162 cubic feet.	
Weight of Rods, boxed, with Couplings, per 100 ft.....	460 lbs.
" 12 H. P. Boiler on Wheels.....	6050 "
" 6x4x6 Duplex Pump	650 "

"B" DRILL.

Weight of Drill <i>without</i> Swivel-Head.....	2320 lbs.
" Swivel-Head boxed separately.....	620 "
" Frame	522 "
" Equipment, page 48.....	2573 "
<hr/>	
Total Weight, Drill and Equipment.....	6035 lbs.
In 9 boxes, occupying, with Frame, about 192 cubic feet.	
Weight of Rods, boxed, with Couplings, per 100 ft.....	516 lbs.
" 15 H. P. Boiler on Wheels.....	6380 "
" 6x4x6 Duplex Pump.....	650 "

"H N" and "C N" DRILLS.

Weight of Drill and Frame.....	"H N" 2100 lbs.;	"C N" 2556 lbs.
" Equipment, page 48.....	"H N" 3165 "	"C N" 3165 "
<hr/>		
Total Weight, Drill and Equipment, "HN,"		5265 lbs.;
		"C N" 5721 lbs.
In 9 boxes, occupying, with Frame, 137 cubic feet.		
Weight of Rods, boxed, with Couplings, per 100 ft.....	725 lbs.	
" 10 H. P. Boiler on Wheels.....	6025 "	
" 6x4x6 Special Pump.....	650 "	

"N" DRILL.

Weight of Drill, <i>without</i> Swivel-Head.....	2360 lbs.
" Swivel-Head boxed separately.....	656 "
" Frame	522 "
" Equipment, page 48.....	3165 "
<hr/>	
Total Weight, Drill and Equipment.....	6703 lbs.
In 9 boxes, occupying, with Frame, about 194 cubic feet.	
Weight of Rods, boxed, with Couplings, per 100 ft.....	725 lbs.
Weight of 20 H. P. Boiler on Wheels.....	7562 "
" 6x4x6 Duplex Pump.....	650 "

"P" DRILL.

Weight of Drill complete <i>without</i> Swivel-Head.....	4480 lbs.
Weight of Swivel-Head boxed separately.....	1419 "
" Frame	870 "
" Equipment, page 48.....	4025 "
<hr/>	
Total Weight, Drill and Equipment.....	10794 lbs.
In 10 boxes, occupying, with Frame, about 296 cubic feet.	
Weight of Swivel-Head and Drive-Rod, when detached, about....	1100 lbs.
" Rods, boxed, with Couplings, per 100 ft.....	725 "
" 25 H. P. Boiler on Wheels.....	7900 "
" 7½x4½x10 Duplex Pump.....	1200 "

Ocean Shipping Weights, Etc., *Concluded*

"P K" DRILL.

Weight of Drill complete.....	10000	lbs.
" Equipment, page 48.....	9920	"
		19920
Total Weight, Drill and Equipment.....	19920	lbs.
Weight of 3½-in. O. D. Drill Rods, boxed, with Couplings, per 100 ft.....	1500	"
Weight of 3-in. O. D. Drill Rods, boxed, with Couplings, per 100 ft.....	1125	"
Weight of "N" Drill Rods, boxed, with Couplings, per 100 ft....	725	"
Weight of "B" Drill Rods, boxed, with Couplings, per 100 ft....	516	"
Weight of 30 H. P. Boiler on Skids.....	8150	"
Weight of 8x4x12 Duplex Pump.....	2700	"

"K" DRILL.

Weight of Drill complete, with Swivel-Head.....	31000	lbs.
" Equipment, page 48.....	9920	"
		40920
Total Weight, Drill and Equipment.....	40920	lbs.
Weight of 3½-in. O. D. Drill Rods, boxed, with Couplings, per 100 ft.....	1500	"
Weight of 3-in. O. D. Drill Rods, boxed, with Couplings, per 100 ft.....	1125	"
Weight of "N" Drill Rods, boxed, with Couplings, per 100 ft..	725	"
" 40 H. P. Boiler on Skids.....	12000	"
" 7½x4½x10 Duplex Pump	1200	"
" 6x4x6 Duplex Pump	650	"

"R" DRILL.

Weight of Drill complete, with Pump and Motor attached.....	1812	lbs.
" Equipment, page 49.....	1374	"
		3186
Total Weight, Drill and Equipment.....	3186	lbs.
In 6 boxes, occupying about 102 cubic feet.		
Weight of Rods, boxed, with Couplings, per 100 ft.....	420	"

"R S" DRILL.

Weight of Drill complete, with Motor.....	2858	lbs.
" Equipment, page 49.....	3436	"
		6294
Total Weight, Drill and Equipment.....	6294	lbs.
In 13 boxes, occupying about 152 cubic feet.		
Weight of Rods, boxed, with Couplings, per 100 ft.....	420	"

"R H" DRILL.

Weight of Drill complete, with Motor.....	2811	lbs.
" Equipment, page 49.....	1986	"
		4797
Total Weight, Drill and Equipment.....	4797	lbs.
In 11 boxes, occupying about 145 cubic feet.		
Weight of Rods, boxed, with Couplings, per 100 ft.....	460	"

How to Select a Suitable Drill Outfit

First, consult table of sizes and capacities on page 47 and choose a machine having capacity nearest beyond the depth you wish to drill. It is always advisable to have at least 100 or 200 feet reserve capacity for emergencies, such as miscalculation in depth where mineral is expected to be found, as well as for reaming and casing the hole, which is often necessary where loose or caving material is encountered; then refer to detailed estimates of complete outfits on pages 56 to 68, which show itemized prices. If an "S" or larger size of drill is wanted and the customer already has a supply of steam or compressed air available for power, the boiler as shown on estimate can be omitted.

Drill Rods. If there are not sufficient Drill Rods shown on estimate to reach the depth desired, add as many more as are needed (up to the capacity of the machine) and at the prices shown on estimates; when more rods are shown on estimates than are required, deductions can be made in the same manner.

Blank Bits, Core Lifters and Core Shells. Our estimate covers an ample supply of these articles,—except for a foreign shipment or long distance from base of supplies—in such cases the amount of these items should be tripled, as these are the small parts used at the point of the drill, and are subject to frequent renewal.

Carbon (Diamonds). The number of Carbon (Diamonds) required depends upon the hardness of the rock and whether the drill will be operated during the day only, or both day and night. If the drill is to be worked only in the daytime and the man who operates the machine is also to set the diamonds, then one set with a couple of extra diamonds as a reserve will suffice; but if the drill is to be worked both day and night two sets will be required, unless the rock is hard enough to require the bits to be set each day, when a third set is necessary, to enable the diamond setter to keep up with the work. The sizes of carbon generally used range from one to four karats each, according to the size of the bit, but it will be found more economical in the end to use carbon just as large as can be set in the different sized bits. We have unusual facilities for procuring the best quality carbon on the market and will be glad to give our customers the benefit of our knowledge and experience in selecting them.

Drive Pipe. The amount of Drive Pipe is governed by the depth of surface or drift deposit to be penetrated, and the estimates cover

enough of this pipe for all ordinary conditions, but where the drift deposit is of considerable depth and mixed with coarse gravel or boulders, two lines of drive pipe should be used; the first or larger pipe must be of sufficient diameter to receive freely the size drive pipe shown in the estimate, which is the smallest size in which the casing can be inserted. This would call for a Drive Head, Drive Shoe and Chopping Bit of corresponding size (see pages 87 and 91). If there is little or no drift deposit on the rock or the Drill is to be used underground, then Drive Pipe as well as other items used in connection with it can be reduced or omitted.

Casing. This is necessary in connection with the Drive Pipe in order to make a tight water connection at bed rock, also to protect the hole from caving when soft or broken strata are encountered below the bed rock; the amount of Casing required would, therefore, depend upon the depth at which such strata are likely to be found. If the rock is not apt to cave then only Casing enough to reach bed rock would be necessary, but if on the other hand, no drift deposit existed and the formation is solid, then this Casing, like the Drive Pipe, as well as items peculiar to its use, would not be required.

General Tools. The balance of the outfit consists of small tools of general usefulness which may be found among a mine equipment and can be deducted at the prices shown on estimates if not required.

Size of Core. When prospecting for soft or friable minerals, such as coal or salt, the best results are obtained by using the "N" size Bits, etc., which make a 2-inch core. Any of our Drills can be equipped with this size Bit and fittings, the additional cost being only the difference between the cost of the "N" Bit and fittings and the regular size, as shown on the estimates, except that for the larger Bit more Carbon is required.

Data to be Given when Inquiring in Regard to Purchase of Drills

- | | |
|--|--|
| 1. Will the work be from the surface or underground? | 7. Kind of mineral to be prospected for. |
| 2. If underground, give dimensions of space available where the drill is to be used, especially in line of drill rods. | 8. Maximum depth of holes. |
| 3. What is the character of the surface or drift deposit overlying the rock? | 9. Total number of feet to be drilled. |
| 4. Kind of rock to be drilled. | 10. Have you compressed air, steam or electricity available for power? |
| 5. Probable amount of surface overlying the rock. | 11. Is there a supply of water close by? |
| 6. Is the rock solid, or broken and liable to cave? | 12. Have you a pump available? |
| | 13. Do you want an experienced drillman? |

Core Drill Estimates

On account of the constant fluctuation in price of material the prices for drill rods, drive pipe and casing are subject to change without notice.

The following estimates cover what experience has shown to be a complete outfit for the different sizes of drills under ordinary conditions. They include an average amount of rods and casing and sufficient supplies (with the exception of carbon) for a large amount of work at a point distant from a base of supplies.

If the rock to be drilled is hard the amount of carbon should be increased. If the rock is likely to be broken and soft, with a great amount of loose surface overlying it, the amount of casing and drive pipe should be increased; while if the rock is solid and the surface light, casing and drive pipe could be omitted.

Where a boiler or air compressor and pump are available, these items can be deducted; this can be done with the tools where the purchaser already has them.

Shipment can be made of any of these outfits, except the "P," within two weeks from receipt of order; the "P" would require thirty days to assemble.

We can always furnish a skilled operator to set the diamond bits and take charge of the drill, and only send out sober and industrious men, who are ready and willing to work, thoroughly understand the operation of the Diamond Drill in every detail and under all conditions, and will work for the interest of their employers. The wages of a man of this class will run from \$100.00 to \$200.00 per month, gold. His traveling expenses must be paid and also his time while traveling both ways. (See page 13.)

Our experience in selling and operating Diamond Drills of all kinds and for a wide variety of work, enables us to prepare estimates for any given conditions, which shall be complete in every detail. We shall be glad to do this when requested, and when we are informed of the conditions under which the drilling is to be done.

“M” Drill Estimate (for Prospecting from Surface or Underground)

1.	“M” Drill and Equipment, as per pages 47 and 49.....	\$ 350.00
2.	1 Hand Hoist (as shown on machine).....	35.00
3.	200 feet Extra Drill Rods (5 ft. sections), making 300 feet with those in Equipment, @ \$75.00.....	150.00
4.	12 Extra Blank Bits, size “E” @ \$1.00.....	12.00
5.	4 Extra Core Lifters, size “E” @ \$2.50.....	10.00
6.	2 Extra Core Shells, size “E” @ \$5.00.....	10.00
7.	1 set Carbon, 6 stones; weight 6 karats, @ \$50.00. (Price of carbon subject to change without notice; see page 87)	300.00
8.	1 Cross Chopping Bit, size “E”.....	5.00
9.	Setting Carbon in one of the above Blank Bits.....	6.00
10.	25 feet Casing Pipe, size “E,” style Flush Coupling, 5 ft. lengths, @ .75.....	18.75
11.	5 pair Protectors for “E” Casing, @ .50.....	2.50
12.	1 Casing Bit, size “E”.....	2.50
13.	1 Bushing, “E” Rods to “E” Casing.....	3.00

Total price, F. O. B., Chicago, Claremont or New York. \$ 904.75

Packing and Boxing for Ocean Shipment, extra. 10.00

Total weight of Drill and outfit as above, about 3,000 lbs.

Code Word, “M” Drill, with above (hand power) outfit complete,
Abinadab.

Code Word, “M” Drill, with above outfit complete, with Drill Rods
and Casing, in 10-ft. lengths for surface work, *Albina.*

If Desired to Operate the Above Machine by Horse Power, Add the Following:

14.	1 Horse Power, with Jack, Belt and Drill Pulley.....	\$ 60.00
	Total price F. O. B. Chicago, Claremont or New York. \$	974.75
	Packing and Boxing for Ocean Shipment, extra.	5.00

One power pump is furnished with the Horse Power outfit, and
is included in price shown on page 47.

Total weight of Drill and outfit as above, about 4,150 lbs.

Code Word, “M” Drill, with horse power outfit as above, complete,
Abinoam.

“E” Drill Estimate (Equipped for Under- ground Prospecting)

1.	“E” Drill and Equipment as per pages 47 and 49.....	\$ 700.00
2.	1 Special Steam Pump, size 4½x2¾x4.....	80.00
3.	100 feet extra Drill Rods (5 ft. sections), making 300 feet with those in Equipment, @ \$75.00.....	75.00
4.	24 extra Blank Bits, size “E,” @ \$1.00.....	24.00
5.	6 extra Core Lifters, size “E,” @ \$2.50.....	15.00
6.	4 extra Core Shells, size “E,” @ \$5.00.....	20.00
7.	1 set Carbon, 6 stones; weight 9 karats, @ \$50.00. (Price of carbon subject to change without notice; see page 87)	450.00
8.	1 Cross Chopping Bit, size “E”.....	5.00
9.	Setting Carbon in one of the above Blank Bits.....	6.00
10.	50 feet Casing Pipe, size “E” style flush coupling, 5 ft. lengths, @ 75c.....	37.50
11.	10 pair Protectors for size “E” Casing.....	5.00
12.	1 pair Casing Pipe Clamps, size “E”.....	4.00
13.	1 Bushings, “E” Rods to size “E” Casing.....	3.00
14.	1 Improved Long Reamer, size “E”.....	22.00
15.	1 extra Reamer Face.....	2.50

Total price, F. O. B. Chicago, Claremont or New York. \$ 1448.50

Packing and Boxing for Ocean Shipment, extra. 15.00

Total Weight of Drill and outfit as above, about 3,700 lbs.

Code word, “E” Drill, with above outfit complete, *Abilities*.

“S” Drill Estimate (Equipped for Prospecting from Surface)

1.	“S” Drill and Equipment as per pages 47 and 49.....	\$1,100.00
2.	8 H. P. Boiler, mounted on wheels, with injector and complete fittings	400.00
3.	1 Special Steam Pump, size 4½ x 2¾ x 4-inch.....	80.00
4.	200 feet Extra Drill Rods (10 ft. sections), making 400 feet with those in Equipment, @ \$65.00.....	130.00
5.	24 Extra Blank Bits, size “E,” @ \$1.00.....	24.00
6.	6 Extra Core Lifters, size “E,” @ \$2.50.....	15.00
7.	4 Extra Core Shells, size “E,” @ \$5.00.....	20.00
8.	1 set Carbon, 6 stones; weight 9 karats, @ \$50.00. (Price of carbon subject to change without notice; see page 87)	450.00
9.	1 Cross Chopping Bit, size “E”.....	5.00
10.	Setting Carbon in one of the above Blank Bits.....	6.00
11.	50 feet Drive Pipe (or Stand Pipe), size 2½ in., @ .50....	25.00
12.	1 Steel Drive Head, size 2½ in.....	6.00
13.	1 Steel Drive Shoe, size 2½ in.....	6.00
14.	1 Drive Pipe Chopping Bit, size 2½ in.....	5.75
15.	1 pair Drive Pipe Clamps, size 2½ in.....	4.50
16.	1 Cast Iron Drive Block.....	10.00
17.	100 feet Casing Pipe, size “E,” style Flush Coupling, 10 ft. lengths, @ .65.....	65.00
18.	10 pair Protectors for “E” Casing, @ .50.....	5.00
19.	1 pair Casing Pipe Clamps, size “E”.....	4.00
20.	1 Bushing, “E” Rods to “E” Casing.....	3.00
21.	1 Improved Long Reamer, size “E”.....	22.00
22.	1 Extra Reamer Face, size “E”.....	2.50
23.	1 Pipe Cutter, cutting pipe to 2 in. diameter.....	2.25
24.	1 set Pipe Stocks and Dies, threading pipe ½-in. to 2-in. diameter	14.00
25.	2 pair No. 13 Chain Tongs.....	12.00
26.	2 Jack Screws	14.00
27.	1 each 6-inch Single and Double Block, with 100 feet of ¾-in Manila Rope.....	6.00
28.	15 feet of ⅜-inch Chain, with Hook and Ring.....	4.00
29.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
30.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00
31.	1 Sledge, Pick, Auger and Ax, with handles.....	3.50
32.	1 lot of Small Pipe, Valves and Fittings; extra Packing and Waste	25.00

Total price F. O. B. Chicago, Claremont or New York. \$2,481.75
Packing and Boxing for Ocean Shipment, extra. 30.00

Total weight of Drill and outfit as above, about 11,200 lbs.

Code Word, “S” Drill, with above outfit complete, *Abismando*.

Code Word, “S” Drill, with above outfit, less Boiler and Pump, *Abis-
maran*.

“H” and “HG” Drill Estimate (Equipped for Prospecting from Surface)

1.	“H” or “HG” Drill and Equipment as per pages 47 and 48.	\$1,700.00	\$1,800.00
2.	10 H. P. Boiler mounted on wheels with injector and complete fittings	425.00	
3.	1 Special Steam Pump, size 4½x2¾x4, with connection and strainer	80.00	
4.	500 feet extra Drill Rods (10 ft. sections), making 700 feet with those in Equipment, @ \$80.00.....	400.00	
5.	24 extra Blank Bits, size “A,” @ \$1.25.....	30.00	
6.	6 extra Core Lifters, size “A,” @ \$3.15.....	18.90	
7.	4 extra Core Shells, size “A,” @ \$5.00.....	20.00	
8.	1 set Carbon, 8 stones; weight 12 karats, @ \$50.00. (Price of carbon subject to change without notice; see page 87)	600.00	
9.	1 Cross Chopping Bit, size “A”.....	6.25	
10.	Setting Carbon in one of the above Blank Bits.....	8.00	
11.	100 feet Drive Pipe (or Stand Pipe), size 3 in., @ .75.....	75.00	
12.	1 Steel Drive Head, size 3 in.....	7.00	
13.	1 Steel Drive Shoe, size 3 in.....	7.00	
14.	1 Drive Pipe Chopping Bit, size 3 in.....	5.75	
15.	1 pair Drive Pipe Clamps, size 3 in.....	6.00	
16.	1 Cast Iron Drive Block.....	17.00	
17.	200 feet Casing Pipe, size 2 in., style Flush Coupling, 10 ft. lengths, @ .50.....	100.00	
18.	20 pair Protectors for 2-inch Casing, @ .50.....	10.00	
19.	1 pair Casing Pipe Clamps, size 2 in.....	4.00	
20.	1 Bushing, “A” Rods to 2 in. Casing.....	3.00	
21.	1 Improved Long Reamer, size 2 in.....	22.00	
22.	1 Extra Reamer Face, size 2 in.....	2.50	
23.	1 Pipe Cutter, cutting pipe to 2 in diameter.....	2.25	
24.	1 Set Pipe Stocks and Dies, threading pipe ½ in. to 2 in. diameter	14.00	
25.	2 pair No. 13 Chain Tongs.....	12.00	
26.	2 Jack Screws	14.00	
27.	1 each 6-inch Single and Double Block, with 100 feet of ¾ in. Manila Rope.....	6.00	
28.	15 feet of ⅜-inch Chain, with Hook and Ring.....	4.00	
29.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25	
30.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00	
31.	1 Sledge, Pick, Auger and Ax, with handles.....	3.50	
32.	1 lot of Small Pipe, Valves and Fittings; extra Packing and Waste.....	25.00	
Total price, F. O. B., Chicago, Claremont or New York.		\$3,630.40	\$3,730.40
Packing and Boxing for Ocean Shipment, extra.		60.00	

Total weight of Drill and outfit as above, about 16,500 lbs.

Code Word, “H” Drill with above outfit complete, *Abillot*.

Code Word, “H” Drill with above outfit less Boiler and Pump, *Abimpfen*.

“ C ” Drill Estimate (Equipped for Prospecting from Surface)

1.	“C” Drill and Equipment as per pages 47 and 48.....	\$2,400.00
2.	12 H. P. Boiler mounted on wheels with injector and complete fittings	460.00
3.	1 Special Steam Pump, size 6x4x6, Duplex, with connection and strainer	125.00
4.	800 feet extra Drill Rods (10-ft. sections), making 1000 feet with those in Equipment, @ \$80.00.....	640.00
5.	24 extra Blank Bits, size “A,” @ \$1.25.....	30.00
6.	6 extra Core Lifters, size “A,” @ \$3.15.....	18.90
7.	4 extra Core Shells, size “A,” @ \$5.00.....	20.00
8.	1 set of Carbon, 8 stones; weight 12 karats, @ \$50.00. (Price of Carbon subject to change without notice; see page 87).....	600.00
9.	1 Cross Chopping Bit, size “A”.....	6.25
10.	Setting Carbon in one of the Blank Bits.....	8.00
11.	100 feet Drive Pipe (or Stand Pipe), size 3 in., @ .75....	75.00
12.	1 Steel Drive Head, size 3 in.....	7.00
13.	1 Steel Drive Shoe, size 3 in.....	7.00
14.	1 Drive Pipe Chopping Bit, size 3 in.....	5.75
15.	1 pair Drive Pipe Clamps, size 3 in.....	6.00
16.	1 Cast Iron Drive Block.....	17.00
17.	200 feet Casing Pipe, size 2 in. style flush coupling, 10-ft. lengths, @ .50.....	100.00
18.	20 pair Protectors for 2-in. Casing, @ 50c.....	10.00
19.	1 pair Casing Pipe Clamps, size 2 in.....	4.00
20.	1 Bushing “A” Rods to size 2 in. Casing.....	3.00
21.	1 Improved Long Reamer, size 2 in.....	22.00
22.	1 extra Reamer Face, size 2 in.....	2.50
23.	1 Pipe Cutter, cutting Pipe to 2 in. diameter.....	2.25
24.	1 set Pipe Stocks and Dies, threading pipe ½ in. to 2 in diameter	14.00
25.	2 pair No. 13 Chain Tongs.....	12.00
26.	2 Jack Screws.....	14.00
27.	1 each 6 in. Single and double Block, with 100 ft. of ¾-in. Manila Rope	6.00
28.	15 feet of ⅜-in. Chain, with hook and ring.....	4.00
29.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
30.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00
31.	1 Sledge, Pick, Auger and Ax, with handles.....	3.50
32.	1 lot of Small Pipe, Valves and Fittings; extra Packing and Waste	25.00
Total price, F. O. B., Chicago, Claremont or New York.....		\$4,643.40
Packing and Boxing for Ocean Shipment, extra....		60.00

Total Weight of Drill and outfit as above, about 19,500 lbs.

Code word, “C” Drill, with above outfit complete, *Abdelasis*.

Code word, “C” Drill, with above outfit complete, less Boiler and Pump, *Abdelari*.

“B” Drill Estimate (for Prospecting from Surface)

1.	“B” Drill and Equipment as per pages 47 and 48.....	\$2,850.00
2.	15 H. P. Boiler mounted on wheels with injector and complete fittings	485.00
3.	1 Special Steam Pump, size 6x4x6 Duplex, with connection and strainer.....	125.00
4.	1800 feet extra Drill Rods (10-ft. sections), making 2000 feet with those in Equipment, @ \$85.00.....	1,530.00
5.	24 extra Blank Bits, size “B,” @ \$1.25.....	30.00
6.	6 extra Core Lifters, size “B,” @ \$3.15.....	18.90
7.	4 extra Core Shells, size “B,” @ \$5.00.....	20.00
8.	1 set Carbon, 8 stones, weight 16 karats, @ \$50.00. (Price of Carbon subject to change without notice; see page 87).....	800.00
9.	1 Cross Chopping Bit, size “B”.....	7.50
10.	Setting Carbon in one of the above Blank Bits.....	8.00
11.	100 feet Drive Pipe (or Stand Pipe), size 4 in., @ \$1.00..	100.00
12.	1 Steel Drive Head, size 4 in.....	10.00
13.	1 Steel Drive Shoe, size 4 in.....	10.00
14.	1 Drive Pipe Chopping Bit, size 4 in.....	7.00
15.	1 pair Drive Pipe Clamps, size 4 in.....	8.00
16.	1 Cast Iron Drive Block.....	17.00
17.	200 feet Casing Pipe, size 2½ in., style flush coupling, 10-ft. lengths, @ 75c.....	150.00
18.	20 pair Protectors for 2½-in. Casing, @ 50c.....	10.00
19.	1 pair Casing Pipe Clamps, size 2½ in.....	4.50
20.	1 Bushing, “B” Rods to size 2½ in. Casing.....	3.50
21.	1 Improved Long Reamer, size 2½ in.....	24.00
22.	1 extra Reamer Face, size 2½ in.....	2.50
23.	1 Pipe Cutter, cutting Pipe to 2 in. diameter.....	2.25
24.	1 set Pipe Stocks and Dies, threading pipe ½ in. to 2 in. diameter	14.00
25.	2 pair No. 13 Chain Tongs.....	12.00
26.	2 Jack Screws	14.00
27.	1 each 7 in. Single and Double Block, with 100 ft. of 1 in. Manila Rope	8.00
28.	15 feet of ¾ in. Chain, with hook and ring.....	4.00
29.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
30.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00
31.	1 Sledge, Pick, Auger, and Ax, with handles.....	3.50
32.	1 lot of Small Pipe, Valves and Fittings; extra Packing and Waste	25.00

Total price, F. O. B. Chicago, Claremont or New York. \$6,315.90
Packing and Boxing for Ocean Shipment, extra.. 70.00

Total Weight of Drill and outfit as above, about 28,000 lbs.

Code word, “B” Drill, with above outfit complete, *Abdaulah*.

Code word, “B” Drill, with above outfit complete, less Boiler and Pump, *Abdebamus*.

“HN” Drill Estimate (for Prospecting from Surface)

1.	“HN” Drill and Equipment, as per pages 47 and 48.....	\$2,000.00
2.	10 H. P. Boiler mounted on wheels, with injector and complete fittings	425.00
3.	1 Special Steam Pump, size 4½x2¾x4 inch Duplex, with connection and strainer.....	80.00
4.	300 feet Extra Drill Rods (10 ft. sections), making 500 feet with those in Equipment, @ \$100.00.....	300.00
5.	24 Extra Blank Bits, size “N” @ \$1.75.....	42.00
6.	6 Extra Core Lifters, size “N” @ \$3.15.....	18.90
7.	4 Extra Core Shells, size “N” @ \$5.00.....	20.00
8.	1 set Carbon, 8 stones; weight 20 karats, @ \$50.00.)Price of Carbon subject to change without notice; see page 87).....	1,000.00
9.	1 Cross Chopping Bit, size “N”.....	10.00
10.	Setting Carbon in one of the above Blank Bits.....	8.00
11.	100 feet Drive Pipe (or Stand Pipe), size 4½ in. @ \$1.25....	125.00
12.	1 Steel Drive Head, size 4½ in.....	11.00
13.	1 Steel Drive Shoe, size 4½ in.....	11.00
14.	1 Drive Pipe Chopping Bit, size 4½ in.....	7.50
15.	1 pair Drive Pipe Clamps, size 4½ in.....	8.00
16.	1 Cast Iron Drive Block.....	17.00
17.	200 feet Casing Pipe, size 3 in., style Flush Coupling, 10 ft. lengths, @ 95c.....	190.00
18.	20 pair Protectors for 3-in. Casing, @ .60.....	12.00
19.	1 pair Casing Pipe Clamps, size 3 in.....	6.00
20.	1 Bushing, “N” Rods to 3 in. Casing.....	4.00
21.	1 Improved Long Reamer, size 3 in.....	28.00
22.	1 Extra Reamer Face, size 3 in.....	3.00
23.	1 Pipe Cutter, cutting pipe to 2 in. diameter.....	2.25
24.	1 set Pipe Stocks and Dies, threading pipe ½ in. to 2 in. diameter	14.00
25.	2 pair No. 14 Chain Tongs.....	17.50
26.	2 Jack Screws.....	14.00
27.	1 each 6-inch Single and Double Block, with 100 feet of ¾ in. Manila Rope.....	6.00
28.	15 feet of ⅜ inch Chain, with Hook and Ring.....	4.00
29.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
30.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00
31.	1 Sledge, Pick, Auger and Ax, with handles.....	3.50
32.	1 lot of Small Pipe, Valves and Fittings; extra Packing and Waste	25.00

Total price F. O. B. Chicago, Claremont or New York. \$4,424.90
Packing and Boxing for Ocean Shipment, extra. 60.00

Total weight of Drill and outfit as above, about 17,000 lbs.

Code Word, “H N” Drill, with above outfit complete, *Abixvo*.

Code Word, “H N” Drill, with above outfit, less Boiler and Pump, *Abixsol*.

“CN” Drill Estimate (for Prospecting from Surface)

1.	“C N” Drill and Equipment, as per pages 47 and 48.....	\$2,700.00
2.	12 H. P. Boiler mounted on wheels, with injector and complete fittings	460.00
3.	1 Special Steam Pump, size 6 x 4 x 6 inch Duplex, with connection and strainer.....	125.00
4.	500 feet Extra Drill Rods (10 ft. sections), making 700 feet with those in Equipment, @ \$100.00.....	500.00
5.	24 Extra Blank Bits, size “N” @ \$1.75.....	42.00
6.	6 Extra Core Lifters, size “N” @ \$3.15.....	18.90
7.	4 Extra Core Shells, size “N” @ \$5.00.....	20.00
8.	1 set Carbon, 8 stones; weight 20 karats, @ \$50.00. (Price of Carbon subject to change without notice; see page 87).....	1,000.00
9.	1 Cross Chopping Bit, size “N”.....	10.00
10.	Setting Carbon in one of the above Blank Bits.....	8.00
11.	100 feet Drive Pipe (or Stand Pipe), size 4½ in. @ \$1.25..	125.00
12.	1 Steel Drive Head, size 4½ in.....	11.00
13.	1 Steel Drive Shoe, size 4½ in.....	11.00
14.	1 Drive Pipe Chopping Bit, size 4½ in.....	7.50
15.	1 pair Drive Pipe Clamps, size 4½ in.....	8.00
16.	1 Cast Iron Drive Block.....	17.00
17.	200 feet Casing Pipe, size 3 in., style Flush Coupling, 10 ft. lengths, @ 95c.....	190.00
18.	20 pair Protectors for 3-in. Casing, @ .60.....	12.00
19.	1 pair Casing Pipe Clamps, size 3 in.....	6.00
20.	1 Bushing, “N” Rods to 3 in. Casing.....	4.00
21.	1 Improved Long Reamer size 3 in.....	28.00
22.	1 Extra Reamer Face, size 3 in.....	3.00
23.	1 Pipe Cutter, cutting pipe to 2 in. diameter.....	2.25
24.	1 set Pipe Stocks and Dies, threading pipe ½ in. to 2 in. diameter	14.00
25.	2 pair No. 14 Chain Tongs.....	17.50
26.	2 Jack Screws	14.00
27.	1 each 6-inch Single and Double Block, with 100 feet of ¾ in. Manila Rope.....	6.00
28.	15 feet of ¾ inch Chain, with Hook and Ring.....	4.00
29.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
30.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00
31.	1 Sledge, Pick, Auger and Ax, with handles.....	3.50
32.	1 lot of Small Pipe, Valves and Fittings; extra Packing and Waste	25.00

Total price F. O. B. Chicago, Claremont or New York. \$5,404.90
Packing and Boxing for Ocean Shipment, extra. 60.00

Total weight of Drill and outfit as above, about 20,000 lbs.

Code Word, “C N” Drill, with above outfit complete, *Abixlum*.

Code Word, “C N” Drill, with above outfit, less Boiler and Pump, *Abixfot*.

“N” Drill Estimate (for Prospecting from Surface)

1.	“N” Drill and Equipment, as per pages 47 and 48.....	\$3,300.00
2.	20 H. P. Boiler mounted on wheels, with injector and complete fittings	525.00
3.	1 Special Steam Pump, size 7½ x 4½ x 6, with Connection and Strainer	175.00
4.	1300 feet Extra Drill Rods (10 ft. sections), making 1500 feet with those in Equipment, @ \$100.00.....	1,300.00
5.	24 Extra Blank Bits, size “N” @ \$1.75.....	42.00
6.	6 Extra Core Lifters, size “N” @ \$3.15.....	18.90
7.	4 Extra Core Shells, size “N” @ \$5.00.....	20.00
8.	1 set Carbon, 8 stones; weight 20 karats, @ \$50.00. (Price of Carbon subject to change without notice; see page 87).....	1,000.00
9.	1 Cross Chopping Bit, size “N”.....	10.00
10.	Setting Carbon in one of the above Blank Bits.....	8.00
11.	100 feet Drive Pipe (or Stand Pipe), size 4½ in. @ \$1.25..	125.00
12.	1 Steel Drive Head, size 4½ in.....	11.00
13.	1 Steel Drive Shoe, size 4½ in.....	11.00
14.	1 Drive Pipe Chopping Bit, size 4½ in.....	7.50
15.	1 pair Drive Pipe Clamps, size 4½ in.....	8.00
16.	1 Cast Iron Drive Block.....	17.00
17.	200 feet Casing Pipe, size 3 in., style Flush Coupling, 10 ft. lengths, @ 95c.....	190.00
18.	20 pair Protectors for 3-in. Casing, @ .60.....	12.00
19.	1 pair Casing Pipe Clamps, size 3 in.....	6.00
20.	1 Bushing, “N” Rods to 3 in. Casing.....	4.00
21.	1 Improved Long Reamer, size 3 in.....	28.00
22.	1 Extra Reamer Face, size 3 in.....	3.00
23.	1 Pipe Cutter, cutting pipe to 2 in. diameter.....	2.25
24.	1 set Pipe Stocks and Dies, threading pipe ½ in. to 2 in. diameter	14.00
25.	2 pair No. 14 Chain Tongs.....	17.50
26.	2 Jack Screws	14.00
27.	1 each 7-inch Single and Double Block, with 100 feet of 1 in. Manila Rope.....	8.00
28.	15 feet of ⅜ inch Chain, with Hook and Ring.....	4.00
29.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
30.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00
31.	1 Sledge, Pick, Auger and Ax, with handles.....	3.50
32.	1 lot of Small Pipe, Valves and Fittings; extra Packing and Waste.....	25.00

Total price F. O. B. Chicago, Claremont or New York. \$6,921.90
Packing and Boxing for Ocean Shipment, extra. 80.00

Total weight of Drill and outfit as above, about 31,200 lbs.

Code Word, “N” Drill, with above outfit complete, *Abiotos*.

Code Word, “N” Drill, with above outfit, less Boiler and Pump, *Abisag*.

“P” Drill Estimate (for Prospecting from Surface)

1.	“P” Drill and Equipment as per pages 47 and 48.....	\$4,000.00
2.	25 H. P. Boiler, mounted on wheels, with injector and complete fittings	600.00
3.	1 Special Steam Pump, size 7½ x 4½ x 10-inch, with connection and strainer.....	300.00
4.	2800 feet extra Drill Rods (10 ft. sections), making 3000 feet with those in Equipment, @ \$100.00.....	2,800.00
5.	24 Extra Blank Bits, size “N” @ \$1.75.....	42.00
6.	6 Extra Core Lifters, size “N” @ \$3.15.....	18.90
7.	4 Extra Core Shells, size “N” @ \$5.00.....	20.00
8.	1 set Carbon, 8 stones; weight 20 karats, @ \$50.00 (Price of Carbon subject to change without notice; see page 87).....	1,000.00
9.	1 Cross Chopping Bit, size “N”.....	10.00
10.	Setting Carbon in one of the above Blank Bits.....	8.00
11.	100 feet Drive Pipe (or Stand Pipe), size 4½ in. @ \$1.25..	125.00
12.	1 Steel Drive Head, size 4½ in.....	11.00
13.	1 Steel Drive Shoe, size 4½ in.....	11.00
14.	1 Drive Pipe Chopping Bit, size 4½ in.....	7.50
15.	1 pair Drive Pipe Clamps, size 4½ in.....	8.00
16.	1 Cast Iron Drive Block.....	17.00
17.	200 feet Casing Pipe, size 3in., style Flush Coupling, 10 ft. lengths, @ 95c.....	190.00
18.	20 pair Protectors for 3-in. Casing, @ .60.....	12.00
19.	1 pair Casing Pipe Clamps, size 3 in.....	6.00
20.	1 Bushing, “N” Rods to 3 in. Casing.....	4.00
21.	1 Improved Long Reamer, size 3 in.....	28.00
22.	1 Extra Reamer Face, size 3 in.....	3.00
23.	1 Pipe Cutter, cutting pipe to 2 in. diameter.....	2.25
24.	1 set Pipe Stocks and Dies, threading pipe ½ in. to 2 in. diameter	14.00
25.	2 pair No. 14 Chain Tongs.....	17.50
26.	2 Jack Screws	14.00
27.	1 each 7-inch Single and Double Block, with 100 feet of 1 in. Manila Rope.....	8.00
28.	15 feet of ⅜ inch Chain, with Hook and Ring.....	4.00
29.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
30.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00
31.	1 Sledge, Pick, Auger and Ax, with handles.....	3.50
32.	1 lot of Small Pipe, Valves and Fittings; extra Packing and Waste	25.00

Total price F. O. B. Chicago, Claremont or New York. \$9,321.90
Packing and Boxing for Ocean Shipment, extra. 100.00

Total weight of Drill and outfit as above, about 48,000 lbs.

Code Word, “P” Drill with above outfit complete, *Abishalom*.

Code Word, “P” Drill, with above outfit, less Boiler and Pump, *Abis-mabas*.

“R” Drill Estimate (Equipped for Under-ground Prospecting)

1.	“R” Drill and Equipment, as per pages 47 and 49.....	\$1,500.00
2.	100 feet extra Drill Rods (5 ft. sections), making 300 feet with those in Equipment, @ \$75.00.....	75.00
3.	24 Extra Blank Bits, size “E,” @ \$1.00.....	24.00
4.	6 Extra Core Lifters, size “E,” @ \$2.50.....	15.00
5.	4 Extra Core Shells, size “E,” @ \$5.00.....	20.00
6.	1 set Carbon, 6 stones; weight 9 karats, @ \$50.00. (Price of Carbon subject to change without notice; see page 87).....	450.00
7.	1 Cross Chopping Bit, size “E”.....	5.00
8.	Setting Carbon in one of the above Blank Bits.....	6.00
9.	50 feet Casing Pipe, size “E,” style Flush Coupling, 5 ft. lengths, @ .75.....	37.50
10.	10 pair Protectors for “E” Casing, @ .50.....	5.00
11.	1 pair Casing Pipe Clamps, size “E”.....	4.00
12.	1 Bushing, “E” Rods to “E” Casing.....	3.00
13.	1 Improved Long Reamer, size “E”.....	22.00
14.	1 Extra Reamer Face, size “E”.....	2.50
15.	5 Horse Power Speed Controller.....	80.00

Total price F. O. B. Chicago, Claremont or New York. \$2,249.00
Packing and Boxing for Ocean Shipment, extra. 25.00

Total weight of Drill and outfit, as per above, about 4,100 lbs.

Code Word, “R” Drill, with above outfit complete, *Abismal*.

Code Word, “R” Drill, with above outfit complete, Drill Rods and Casing in 10 ft. lengths for surface work, *Abism*.

“RS” Drill Estimate (Equipped for Prospecting from Surface)

1.	“R S” Drill and Equipment, as per pages 47 and 49.....	\$1,800.00
2.	1 Triplex Pump, size 3 x 3-inch, with 3 H. P. Electric Motor attached	350.00
3.	300 feet Extra Drill Rods (10 ft. sections), making 500 feet with those in Equipment, @ \$65.00.....	195.00
4.	9 H. P. Speed Controller for Drill.....	90.00
5.	3 H. P. Speed Controller for Pump.....	60.00
6.	24 Extra Blank Bits, size “E,” @ \$1.00.....	24.00
7.	6 Extra Core Lifters, size “E,” @ \$2.50.....	15.00
8.	4 Extra Core Shells, size “E,” @ \$5.00.....	20.00
9.	1 set Carbon, 6 stones; weight 9 karats, @ \$50.00. (Price of Carbon subject to change without notice; see page 87).....	450.00
10.	1 Cross Chopping Bit, size “E”.....	5.00
11.	Setting Carbon in one of the above Blank Bits.....	6.00
12.	50 feet Drive Pipe (or Stand Pipe), size 2½ in., @ .50.....	25.00
13.	1 Steel Drive Head, size 2½ in.....	6.00
14.	1 Steel Drive Shoe, size 2½ in.....	6.00
15.	1 Drive Pipe Chopping Bit, size 2½ in.....	5.75
16.	1 pair Drive Pipe Clamps, size 2½ in.....	4.50
17.	1 Cast Iron Drive Block.....	10.00
18.	100 feet Casing Pipe, size “E,” style Flush Coupling, 10 foot lengths, @ .65.....	65.00
19.	10 pair Protectors for “E” Casing, @ .50.....	5.00
20.	1 pair Casing Pipe Clamps, size “E”.....	4.00
21.	1 Bushing, “E” Rods to “E” Casing.....	3.00
22.	1 Improved Long Reamer, size “E”.....	22.00
23.	1 Extra Reamer Face, size “E”.....	2.50
24.	2 pair No. 13 Chain Tongs.....	12.00
25.	2 Jack Screws.....	14.00
26.	1 each 6-inch Single and Double Block, with 100 feet of ¾-in Manila Rope.....	6.00
27.	15 feet of ⅜-inch Chain, with Hook and Ring.....	4.00
28.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00
29.	1 Sledge, Pick, Auger and Ax, with handles.....	3.50

Total price F. O. B. Chicago, Claremont or New York. \$3,219.25

Packing and Boxing for Ocean Shipment, extra. 25.00

Total weight of Drill and outfit as above, about 10,000 lbs.

Code Word, “R S” Drill, with above outfit complete, *Abismamos*.

"R H" Drill Estimate (Equipped for Prospecting from Surface)

1.	"R H" Drill and Equipment as per pages 47 and 48.....	\$2,000.00
2.	1 Triplex Pump, size 3 x 3 inch, with 3 H. P. Electric Motor attached	350.00
3.	500 feet extra Drill Rods (10 ft. sections), making 700 feet with those in Equipment, @ \$80.00.....	400.00
4.	12 H. P. Speed Controller for Drill.....	112.00
5.	3 H. P. Speed Controller for Pump.....	60.00
6.	24 Extra Blank Bits, size "A," @ \$1.25.....	30.00
7.	6 extra Core Lifters, size "A," @ \$3.15.....	18.90
8.	4 Extra Core Shells, size "A," @ \$5.00.....	20.00
9.	1 set of Carbon, 8 Stones; weight 12 karats, @ \$50.00. (Price of carbon subject to change without notice; see page 87).....	600.00
10.	1 Cross Chopping Bit, size "A".....	6.25
11.	Setting Carbon in one of the above Blank Bits.....	8.00
12.	100 feet Drive Pipe (or Stand Pipe), size 3 in., @ .75.....	75.00
13.	1 Steel Drive Head, size 3 in.....	7.00
14.	1 Steel Drive Shoe, size 3 in.....	7.00
15.	1 Drive Pipe Chopping Bit, size 3 in.....	5.75
16.	1 pair Drive Pipe Clamps, size 3 in.....	6.00
17.	1 Cast Iron Drive Block.....	17.00
18.	200 feet Casing Pipe, size 2 in., style Flush Coupling, 10 ft. lengths, @ .45.....	90.00
19.	20 pair Protectors for 2-inch Casing, @ .50.....	10.00
20.	1 pair Casing Pipe Clamps, size 2 in.....	4.00
21.	1 Bushing, "A" Rods to 2 in. Casing.....	3.00
22.	1 Improved Long Reamer, size 2 in.....	22.00
23.	1 Extra Reamer Face, size 2 in.....	2.50
24.	1 Pipe Cutter, cutting pipe to 2 in. diameter.....	2.25
25.	1 Set Pipe Stocks and Dies, threading pipe 1/2 in. to 2 in. diameter	14.00
26.	2 pair No. 13 Chain Tongs.....	12.00
27.	2 Jack Screws	14.00
28.	1 each 6-inch Single and Double Block, with 100 feet of 3/4 in. Manila Rope.....	6.00
29.	15 feet of 3/8-inch Chain, with Hook and Ring.....	4.00
30.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
31.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00
32.	1 Sledge, Pick, Auger and Ax, with handles.....	3.50
33.	1 lot of Small Pipe, Valves and Fittings; extra Packing and Waste	25.00

Total price F. O. B. Chicago, Claremont or New York. \$3,947.40
Packing and Boxing for Ocean Shipment, extra. 60.00

Total weight of Drill and outfit as above, about 9,500 lbs.

Code Word, "R H" Drill, with above outfit complete, *Abirol*.

Code Word, "R H" Drill, with above outfit, less Boiler and Pump, *Abiobas*.

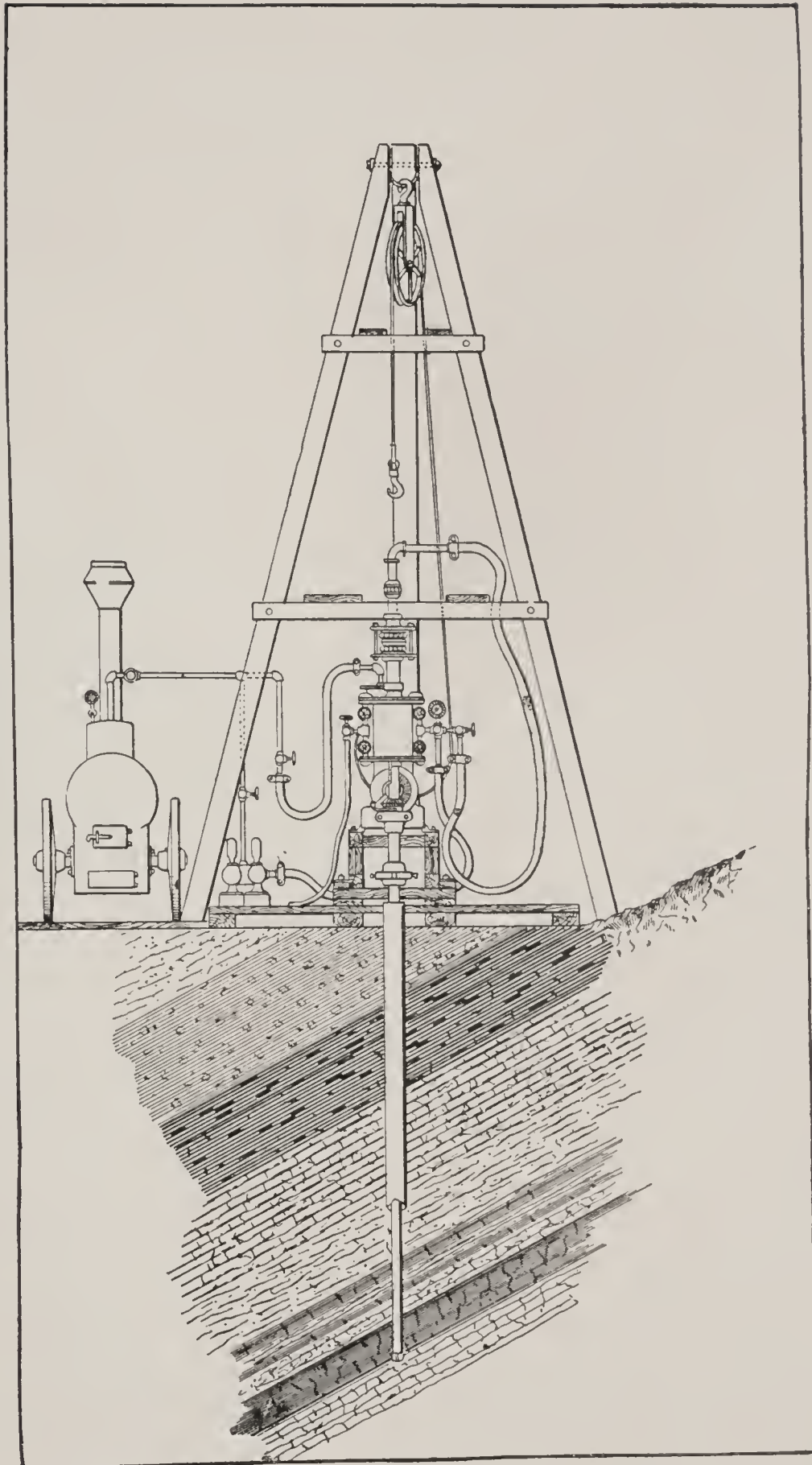
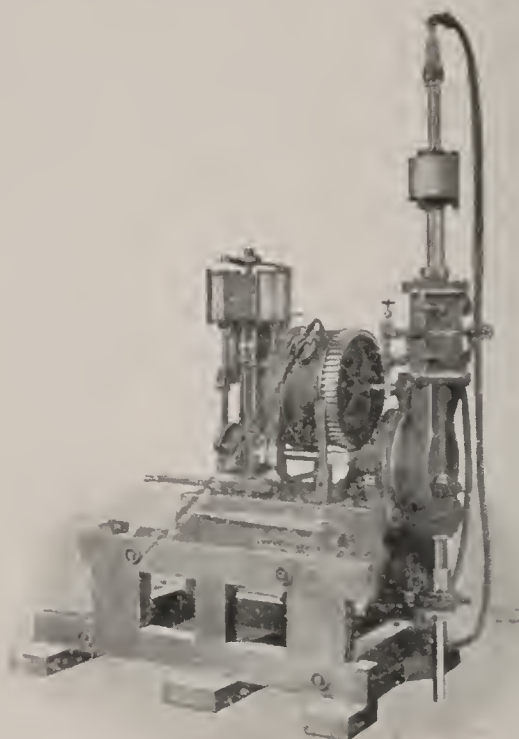


Fig. 24.

**Drill, Derrick, Boiler, Pump, Etc.,
Erected Ready for Work**

Surface Prospecting with the Sullivan Diamond Core Drill

So various are the conditions of drilling prospect holes in different parts of the country, in different seasons and for different depths and material penetrated, that it is impossible to describe processes which will be applicable to all cases. In what follows we shall endeavor to give a general description of the work of prospecting, with some of the difficulties which may at any time be encountered, and ways of avoiding them, or of overcoming them after they have appeared, together with some mention of the tools used in general work of this kind. This description refers principally to conditions such as are most frequently met with in prospecting work, where the ground and surroundings are fairly well suited to the hauling and handling of the machinery and the arrangement of the shanty, tripod and outfit; but the drill can be used in the roughest and most mountainous country, with such modifications of the following instructions as the conditions and requirements of the work may make necessary.



Limited space prevents a complete description, yet what is given may be found of value to those interested in the development of mineral lands, as showing the thorough manner in which Diamond Drill prospecting is conducted, and the means adopted to secure rapid and accurate work with the SULLIVAN DRILL and the special tools and devices used with this machine. In case of peculiar accidents or difficulties, we shall be pleased to give correspondents the benefit of our wide experience in all kinds of prospecting, and can send men to take charge of and operate Diamond Drills until the difficulty is passed.

Location of Prospect Hole. The approximate location of the prospect hole is determined by the extent, location and general features of the land to be developed. The outfit should be placed within reach of a good supply of water for the pump; if this is not practicable,

water must be hauled for this purpose. When the available supply of water is limited, it may be used over and over by allowing the water as it comes from the hole to run back into the tank or well from which it was pumped, and allowing the cuttings from the hole to settle. By so doing, only enough water need be hauled to supply the waste and feed the boiler.

Foundation and Floor. It is customary to lay four timbers, size about 6 x 12 or 8 x 12 inches, and 12 feet long, for the foundation of the drilling plant, covering about 12 square feet on the ground. These are leveled up, and a floor of sound two-inch planks laid across them. The drill and pump are set on this floor—the former a little back of the middle, directly over two foundation timbers running parallel with length of drill, about three feet apart. The drill is bolted to these two timbers. A hole is cut in the floor in front of the drill, through which the pipe is afterward sunk and the rods pulled and lowered in drilling. The cut on page 69 showing drill, tripod or derrick, pump, foundation and floor timbers, boiler, etc., will be found valuable in connection with this description.

The Shanty. With the foundation and floor in position, the shanty is erected over them. A common shed-roofed shanty answers every purpose. It should be built in sections, bolted together, so that it can be easily taken down, moved and put up again. A convenient size is 12 x 12 feet, 7 feet high at back end and 9 feet at front end, with roof strong enough to walk on, as two or three men are frequently on it. A roof of one inch sound Norway pine, with matched joints, answers every purpose of support and protection. It should have a hole directly over the bore hole large enough to admit the drive block. The rods and attached hose also pass through this hole in drilling and in pulling and lowering. In mild weather the shanty encloses only the 12 x 12 floor. In cold weather the boiler is also enclosed, and keeps the shanty warm.

Boiler. The most usual kind, where it can be hauled about, is an ordinary horizontal portable boiler, mounted on wheels. It is sometimes more convenient to use a vertical boiler, which can be carried on skids; and in some cases where transportation is very difficult, a sectional boiler is necessary, which can be "packed" from place to place. Capacities of boilers required for the different drill outfits are given on page 97. It must be borne in mind that these boilers have to furnish steam for both drill and pump. A smaller boiler than that given in the table would be ample for ordinary work, as the

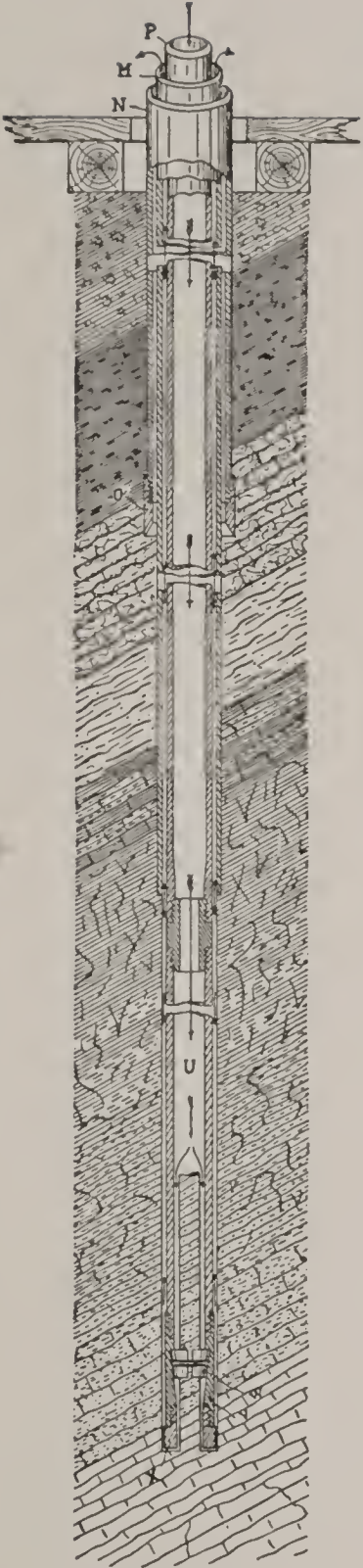


Fig. 25.

Section showing Drill Pipe *N*, with Drive Shoe *O*, Casing *M*, Rods *P* Core Lifter *W*, Bit *X* Core Barrel *U* and Shell *V*.

SULLIVAN DRILLS are economical in use of steam, as are also the pumps we furnish. The larger boiler is recommended so that the surplus power available can be instantly drawn upon in case of emergency.

The position of the boiler is usually at the left of the platform just described, and close to it for convenience in piping to drill and pump. The fire door is toward the front of the shanty, wheels about 12 to 18 inches from the platform, and the dome should be nearly opposite the drill hole, so that the steam valves to pump and drill can be easily reached by the operator as he stands in front of the drill. The boiler may be hauled into position before the shanty is put up. (See cut on page 69.)

Pump. With the pump tables will be found a note giving the size of pumps suitable for our drills (see page 99). We handle an excellent make of pumps, which we can recommend for all drilling and mining service. For our power drills we use special pumps, with large steam cylinders, capable of working with water pressure of 150 to 200 pounds. Our "M" Hand Drill is provided with a lever hand pump furnished with the outfit, our "R" Electric Drill has a pump attached to the drill bed-plate, and operated from the crank-shaft. The "R S" and "R H" Electric Drills have a triplex electric pump, driven by separate motor.

Connections. Connections for steam, exhaust and water can be made by any competent drill-runner, and are shown in the general view on page 69. Our outfits when shipped include pipe, hose, and fittings for all ordinary setting up.

Connections should be as short and straight as possible, and for winter, arrangements must be made to protect exposed pipes, and to drain all pipes when left over night. Also the hydraulic cylinder should be drained in cold weather, by means of pet-cocks provided for that purpose.

The Derrick in most general use is the ordinary tripod, varying in height and weight with the work to be done. Our sectional derricks (see detailed description and cut on pages 101 and 102), constructed entirely of iron and steel, are the most convenient, and are practically indestructible. Their light weight, and being made sectional without any pipe threads, make them portable and easy to erect and dismantle. Where timber is plentiful, the prospector usually procures three poles not less than thirty-five feet long, and fastens them at the top by a bolt, from which the hoisting sheave is hung. These will make a derrick giving a lift of thirty feet in the clear, which is sufficient for ordinary work. In deep-hole work—1,000 feet or more—the three-pole timber derrick will hardly answer, and for such work we recommend our iron and steel derrick of the three or four-pole type, which is strongly braced and fastened with bolts to facilitate erection.

Stand-Pipe. When the first rock stratum is only a few feet below the surface, the stand-piping is very quickly and easily done. Usually, however, there are from 15 or 20 up to 300 feet or more of sand, gravel, clay and other drift material to be penetrated, and through this pipes must be sunk to the rock, so as to keep out all this loose material while drilling. The size, quantity and kind of stand-pipe depend upon local circumstances. If much drift is anticipated, it is better to start with a large pipe, driving it as far as possible, and finishing with one or two smaller sizes. Where several sizes are used, each is subjected to only part of the friction of the loose material in pulling it out, and hence is more easily pulled. The smallest size of stand-pipe must admit the largest casing to be used. The sectional view of drill hole on page 72 shows the relative position of drive-pipe casing and drill rods.

Driving Stand-Pipe. A good way of starting the pipe through soft clay is to drill a hole to any practicable depth, large enough to admit the stand-pipe, which is then lowered into it. Beyond this depth the pipe must be driven. A *Drive-Head and Shoe* (Fig. 36) are screwed to top and bottom of the pipe, the head receiving the blows of a heavy hard-wood or iron drive-block, the shoe cutting its way through the drift. The drive-block is raised by the engine and a rope, and dropped from a suitable height, striking 25 to 50 blows per minute. For this work the wire rope is removed from the hoisting drum, and a manila rope attached at one end to the drive-block, passed over the sheave at the top of the derrick, and the other end wound two or three times around the drum. The engine and drum are run continuously, while

a man alternately pulls and loosens the free end of the rope. When the end of the rope is pulled, the friction of the two or three turns of rope against the drum is sufficient to raise the drive-block; when it is loosened, the rope slips on the drum, and the drive-block falls. A wash-pipe is lowered inside the drive-pipe, following the shoe down and stirring up the loose material, which is carried to the surface by a stream of water forced down inside the wash-pipe. This stream will wash up sand and clay and gravel up to about $1\frac{1}{2}$ inches in diameter. Where coarser gravel or boulders are encountered, they must be chopped to pieces.

Chopping. For this purpose *Chopping-Bits* are used (Fig. 30). These are made of steel, with hardened chisel-shaped edges, and are screwed to the lower end of the wash-rod. Rod and bit are then jumped up and down, as in driving, breaking the large gravel. When boulders are encountered in sinking stand-pipe it is necessary to blast them away by using dynamite.

A charge of dynamite is attached to the wires of a blasting battery and lowered to the boulder. The pipe is next withdrawn four or five feet to avoid being damaged by the blast, and the charge then exploded by the battery. On large boulders several blasts may be necessary to break them sufficiently. After each blast the chopping is resumed as described above.

When rock is reached, the stand-pipe must be driven and chopped into it so as to make a tight joint, to prevent the escape of water from the hole and to prevent sand and loose material from getting in. If a tight joint cannot be had at bottom of stand-pipe the rock must be drilled into, a short distance, and casing inserted, when the sediment settling around it will keep the water in the hole.

Drilling. With the work carried as far as described, everything is ready for the drilling proper. This, when commenced, is carried on night and day, to make the most rapid progress possible. The drill outfit is in charge of a foreman. In soft formations, the foreman sets the bits and runs the drill daytimes with his helper, who fires the boiler and assists in pulling up and lowering the rods. The assistant foreman runs the drill at night with a helper. In hard formations the foreman spends all his time setting bits, and has two assistants to run the drill. All the men work together while sinking the stand-pipe, the night work beginning with the drilling.

Bit, Core-Shell and Core-Barrel. Fig. 29 shows the bit, by means of which, with the core-lifter, core shell and core-barrel, the hole is drilled and the core formed, broken off and held while brought

to the surface. These tools are also shown in their relative positions in Fig. 25, page 72. The bit first penetrates the rock. It is set, on its lowest face and inner and outer edges, with the small pieces of "black diamond" or carbon. This is a form of pure carbon, as hard as the brilliant, but of a dark gray or reddish black color, opaque and not crystalline. Stones of one to three karats weight are used in ordinary drilling, varying according to the size of the bit.

Core-Lifter. As the bit is rotated and fed forward, the diamonds chip and grind away the rock in an annular hole, leaving untouched in the center a cylindrical "core." The bit passes down over this core followed by the core-shell and core-barrel. The latter is a smooth-bored tube in which the core is enclosed. The *Core-Lifter*, Figs. 25, 34 and 35, is placed in the shell, in the position shown. The construction of the core-lifter allows it to move down over the core; but when the rods are raised, it grips the core, holds it firmly, and as the rods rise, breaks it off.

Lowering the Rods. The drill being slid back out of the way, on its frame, the bit and core-shell are screwed to the bottom of the core-barrel, lowered into the hole and supported while a drill rod is screwed into the upper end of the core-barrel. The *Hoisting Plug or Lifting Swivel* (Fig. 37) is then screwed into the upper end of the drill rod, the hoisting rope hooked on, and the rods lifted a few inches while the supporting clamp is taken off. Disconnecting the hoisting gears, the core-barrel and rod are lowered by the brake until the hoisting plug is a few inches from the floor, when the *Safety Clamp* (Fig. 33) is placed around the drill rods.

This tool is provided with toothed jaws, so arranged as to be closed together by the downward pull of the weight of the rods, holding them firmly, and yet easily loosened by any *upward* movement of the rods. Thus the rods can at any time be pulled up through the clamps, which, however, grasps and sustains them as soon as the upward movement ceases and the weight of the rods falls on the clamp; it is, in fact, self-operative, and prevents the rods from dropping into the hole in case of breakage of hoisting rope or sheave.

The last drill rod to be screwed on is first passed through the drive-rod of the drill, which is moved forward over the hole at this time. The rods are then lowered carefully to the bottom, if the hole is clean, and the *Water-Swivel* (see page 94), also *Q*, (Fig. 4), being attached and the feed-piston in its highest position, and the rods held fast in the chuck *L*, drilling is begun. The operation of feed-valves and piston has been described on pages 9 and 10. When the piston

reaches the bottom of the cylinder, the chuck is loosened, and by shutting valves 1 and 3, and opening 2 and 4, the piston runs up in a few seconds, the rods resting on the bottom of the hole; the chuck then grasps them again and the drilling continues, additional rods being added at the top as the hole becomes deeper.

The water-swivel is connected with the pump while drilling, and a stream of water is constantly forced through it and down inside the rods, coming out through the bit at the bottom of the hole, and rising to the surface through the clearance space cut by the diamonds in the outer face of the bit. This stream of water keeps the diamonds cool, and washes up the cuttings, keeping the hole clean, and enables the operator to tell from the appearance of the cuttings and the color of the water the nature of the rock being penetrated.

If the hole has mud or broken rock in the bottom, the rods are lowered to this, the water-swivel and lifting bail attached, and the water forced through the rods while they are lowered to the bottom, washing up the mud and bits of rock.

Pulling Up. After drilling as many runs as will fill the core-barrel, the rods are pulled up until the top joint reaches the surface, disconnected at this joint, and the drill moved back on the frame, out of the way. The rods are then hoisted through the safety-clamp, and uncoupled in double lengths, or longer, the helper standing on the platform, at a suitable height on the tripod or derrick. When the core barrel, shell and bit reach the surface, the shell is unscrewed from the barrel, the core removed in exact order, in pieces up to three or four feet or more in length. Solid pieces of the core can be subjected to physical and chemical tests, and thus the exact nature of the mineral, as well as its depth and the thickness of the vein, can be determined with perfect accuracy.

Economy of Time. The operations of pulling and lowering the rods are conducted by the two men operating a shift, one standing at the drill and his helper on the roof or platform above. They work together in such a manner that both are constantly busy, and no time is lost between the successive operations. By this arrangement several hundred feet of rods can be pulled or lowered in a very few minutes.

Lifting-Bail and Clevis. When the water-swivel is attached, before the bottom of the hole is reached, the rods are suspended from a *Lifting-Bail and Clevis* (Fig. 28). The clevis is placed around the rods under a shoulder on the water-swivel and the bail hangs from the hook on the hoisting rope.

Improved Water-Swivel. Fig. 43 shows this tool, which allows the rods to be kept turning while lowering through mud or broken rock, with a stream of water passing through them as in drilling, and washing up the mud and bits of rock.

SPECIAL WATER-SWIVEL.

This is a special water-swivel with hoisting-swivel combined. See Fig. 44 on page 94.

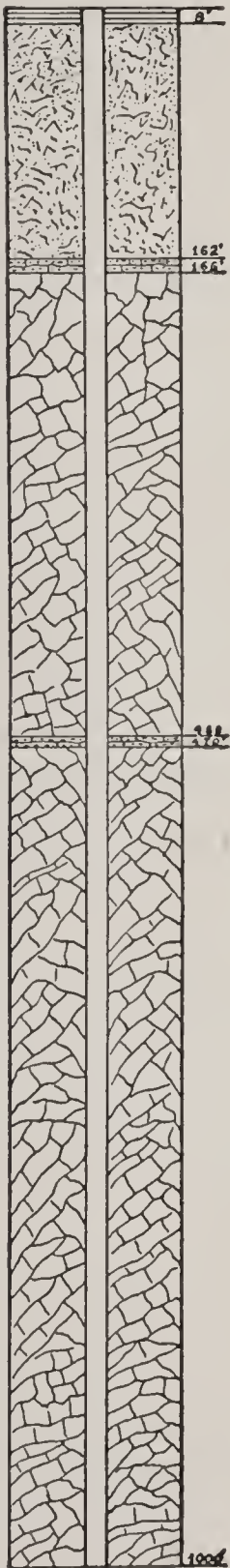


Fig. 26.

Record of Core Drilling
in Rock Salt,
New Iberia, La.

Reaming and Casing. Casing-pipe is used to keep the hole clean and to prevent caving. When its use is found necessary, the hole is enlarged to a suitable diameter by means of a *Reamer*. See page 92. No core is made in reaming, the object being simply to enlarge the hole. Our reamer is designed to prevent vibration, and make a straight hole with the least possible wear of carbon. It consists of ten feet of extra heavy pipe attached to the drill rods by a bushing, and the reamer proper at the bottom. The guide is one piece with the reamer head and fits into the drill-hole. The reamer head is threaded at the top to hold the face, which consists of a swedes iron ring into which the diamonds are set. These cut away the sides of the hole and when the metal is worn they are reset in the new face. Water passes through the reamer, as through the bit in drilling, and washes up the cuttings.

When necessary to ream and case below casing already in the hole, the latter may be pulled out, and the hole continued the same size; or the first casing may be left in, and the hole reamed out to admit casing of a smaller size, provided it in turn will admit the drill rods. For "A" core-barrel (see page 89), the smallest casing should be at least 2-inch; for "B" core-barrel, 2½-inch; for "E" core-barrel, 2-inch; for "N" core-barrel, 3-inch. When two sizes of casing are necessary the larger size is put in part way down, and the smaller to the whole depth necessary. Larger casing for "A" core-barrel is 3-inch; for "B" 3½-inch; for "E" 3-inch, and for "N" 4-inch.

Each size of stand-pipe and casing comes to the surface, where there are thus always several sizes of pipe, concentric as shown in Fig. 25. Pipe being lowered within larger pipe is held, as each joint is made at the surface by a *Pipe Clamp* shown in Fig. 32. Fig. 25, page 72, shows drive pipe (N), drive shoe (O), casing pipe (M) and drill rod (P); core-shell (V), core-lifter (W), and bit (X) in position around a piece of core in the bottom of a drill hole. Casing may be of ordinary pipe, but this is difficult to pull out on account of the couplings.

Flush Coupling Casing. Where casing must be frequently pulled, we recommend *Flush Coupling Casing*, described on page 87. Fig. 31 shows a short piece of it, provided with cast iron protectors to save the threads from injury in shipping.

Recovering Taps. Figs. 39, 40 and 41 show three forms of these tools, which are used to pull the rods to the surface in case of breaking them or dropping them into the hole.

Indications of the Machine in Drilling. By means of gauges attached to the hydraulic cylinder, and by watching the operation of the drill, the operator can tell at once when the character of the rock being penetrated changes. All these indications of the machine and gauges should be closely watched, as well as the cuttings as they come to the surface. For the indications show the thickness of strata, and the cuttings the character of the rock, before the core is pulled up; and they and the core act as checks, which establish the accuracy of the work beyond question. *On entering a vein of coal or soft ore*, these indications are *specially marked*, and give positive evidence of the presence of the mineral.

Running through Coal. On reaching coal it is customary to run into it a few inches, then pull up, put everything in perfect order, and put down again to run through the vein. By so doing there is no other core to grind away in the core-barrel and come up with the cuttings, or to grind away the coal itself.

Double Tube Core Barrel. This Core Barrel was designed especially for prospecting in formations of extreme friability, such as soft bituminous coal.

It is composed of two barrels, one of which is suspended inside the other. This arrangement permits the inner barrel, which receives the core, to remain stationary while the outer barrel revolves, and thus prevents all possibility of the core being worn or injured in any way by pressing against a revolving surface.

By this method the core from soft formations is usually brought to the surface in perfect condition.

Prospecting in Salt and other Friable or Soluble Materials

It has been incorrectly claimed by persons not familiar with THE SULLIVAN DIAMOND CORE DRILL that it is impossible to obtain cores from rock salt formations, owing to the extreme solubility and friability of the mineral. These claims are shown to be entirely without foundation by the fact that we have drilled hundreds of feet through rock salt in Louisiana and Kansas, obtaining *full core* for the whole thickness of the deposit. The following letters and cut on page 77 will be interesting in this connection:

THE ROYAL SALT COMPANY, CHICAGO.

SALT WORKS AND MINE LOCATED AT KANOPOLIS, ELLSWORTH Co., KAN.

F. K. COPELAND, *President*.

SPRINGFIELD, OHIO, March 23, 1891.

DEAR SIR: In answer to yours of the 18th, we would say, it gives us pleasure to state that you drilled nearly 1,000 feet with a Diamond Drill for us, and did it to our entire satisfaction, and your price was much lower than the bid of others. We found your workmen very obliging and accommodating, and also very careful to get an accurate and full core of all the material passed through, which was a variety of rock for over 600 feet and salt for over 200 feet. Since the Diamond Drill Core was furnished by you, we have sunk a shaft about 9 x 23 feet to a depth of over 800 feet, and have been surprised how accurately the core showed each and every stratum passed through, which is proven by the shaft which is just completed. The shaft has proven the diamond drilling to be remarkably accurate in salt, as well as other strata passed through. Wishing you the success your efforts deserve, we remain,

Very truly yours,

ROYAL SALT COMPANY,
J. S. CROWELL, *President*.

NEW IBERIA SALT CO.'S MINE, NEAR NEW IBERIA, LA.

AVERY P. O., IBERIA PARISH, LA., March 31, 1891.

F. K. COPELAND, *President*.

DEAR SIR: Your favor of 13th inst. to hand. We beg leave to say in reply that the three holes you drilled for us were put down in such a satisfactory manner that we had no fault whatever to find. One hole was 732 feet deep, and two others each 250 feet deep. The material drilled in was solid rock salt all the way to the bottom of the holes, except about 25 feet at the surface, which was earth. The holes were drilled very expeditiously and the core obtained was perfect, showing every inch of material passed through. The price contracted for was reasonable and no disagreement occurred as to carrying out contract stipulations. Should we require such work in the future we would apply to you without hesitation.

Yours truly,

NEW IBERIA SALT CO.,
S. L. McCALLA, *General Manager*.

The above letter and diagram on page 77 refer to separate contracts, both at New Iberia, La., the former for New Iberia Salt Co., the latter for J. M. Avery.

Exploring with the Government Diamond Drill in Ontario, Canada

Extract from paper by THOS. W. GIBSON, Bureau of Mines, Toronto, in *Canadian Mining Review*, June, 1896:

Where the object of drilling is to determine the presence and situation of bodies of ore, it is essential that a record of the borings should be systematically kept. For this purpose the cores as they are brought up should be carefully laid away for reference and examination, which is usually done by placing them in shallow boxes not exceeding in depth the diameter of the core, a foot or so in width and eight or ten feet long. The various sections of the core should be divided from one another by longitudinal strips of wood, and should be labeled with the number of the hole and depth from which they are taken. The drill manager should also keep a daily record of the work done by the drill, and note all items of interest, causes of delay, etc., from which he should make daily or weekly reports of progress to his employers.

The cost of work with the Diamond Drill depends to a very large extent upon the nature of the rock strata being penetrated, being greater in dense and broken, and less in the softer and more compact rocks. Distance from means of communication and transport is also an item of importance. It frequently happens that operations are carried on in some remote spot where the roads are bad and where supplies of any kind are hard to get. Under such circumstances the cost is somewhat increased, both on account of the difficulty in hauling in the plant, and the necessity of starting a camp for accommodation of the men engaged on the drill.

In 1894 the Legislature of Ontario passed an Act relating to Mines and Mining lands, which provided among other things for the purchase by the Government of two Diamond Drills to be used in the exploratory drilling of ores or minerals in the Province, and in the same session the sum of \$15,000 was appropriated to carry out the provisions of the Act. Only one drill has yet been bought, the preference being given after careful investigation to the machine manufactured by the SULLIVAN MACHINE COMPANY, of Claremont, N. H., and Chicago. A drill of the "C" class made by this company was purchased in August, 1894, at a cost, including certain extra equipment, of \$3,760.

The first property on which the diamond drill was employed was the Glendower iron mine. The aggregate depth of the borings was 2,626½ feet, and the time consumed was 180 days of actual boring, or at the rate of 14½ feet per day. The rock formations pierced were limestone and granite, with bands of hornblende and quartz. In some places the strata were found to be more or less broken up and obstructive to the drill, but on the whole the ground, especially the limestone, was easily drilled through, and good progress was made, the drill frequently going as much as 30 feet in a day.

The result of the operations was to show that a very considerable body of good ore existed between masses of mixed ore. The total cost of the work was \$2,591.18, or \$0.986 per foot of boring. The various items of expense were as follows:

	Total Cost.	Cost Per Foot.
Freight	\$ 63.58	\$0.024
Lumber, hardware and other supplies..	162.24	0.061
Wood	308.07	0.117
Teaming and labor.....	393.72	0.150
Repairs and renewals.....	81.95	0.031
Diamonds, @ \$17.38 per karat.....	494.34	0.188
Fireman	354.72	0.135
Superintendence	732.56	0.278
Total	\$2,591.18	\$0.986

The cost was divided between the Bureau of Mines and the owners of the property in the proportions provided for by the regulations.

After work was concluded at the Glendower mine, the drill was removed to Lake Wahnapiatae, on the property of the Bonanza Nickel Mining Company, where a white quartz vein of great width had been discovered, which, though carrying no visible gold, had shown by assays a value of as high as \$100 per ton. The drill was got to the location with some difficulty, owing to the rough country through which it had to be taken from the railway station. The conditions were found to be very different from those at Glendower. The hardest kind of granite was encountered for a distance of 138 feet, when the quartz was struck and drilled through a distance of 65 feet, the hole ending in the hanging wall at a total depth of 205 feet. The second prospect was located on the line of the vein 350 feet away from the first. The drilling was begun in quartz and ended in granite at a depth of 91 feet. The quartz, granite and syenite penetrated by the drill afforded the most difficult sort of boring. The rate of progress was consequently slow, and the cost per foot between four and five times as high as at the Glendower mine. The loss in weight of diamonds was 23.070 karats, and the cost of this item per foot of boring was upwards of seven times as great as at Glendower, showing conclusively the obdurate nature of the strata pierced. Following is a statement in detail of the cost of work:

	Total Cost.	Cost Per Foot.
Freight	\$ 66.70	\$0.225
Labor and teaming.....	109.87	0.371
Wood	111.82	0.377
Lumber and drill supplies.....	43.00	0.145
Renewals and repairs.....	118.35	0.400
Diamonds, @ \$17.38 per karat.....	898.06	0.307
Fireman	141.49	0.477
Superintendence	284.47	0.961
Total	\$1,279.42	\$4.322

The drill was at work on this property from August 5th to October 23d, 1895, 69 working days in all, the average rate of progress per day being 4 feet 3 inches.

Combining the operations of the drill at both places it is found that a total depth of 2,922½ feet in eight holes has been bored by the machine since it was placed in the field, in 249 days' actual work, at an aggregate cost of \$3,870.60, or \$1.324 per foot.

Following are the items of cost:

	Total Cost.	Cost Per Foot.
Freight	\$ 130.28	\$0.044
Labor and teaming.....	503.59	0.172
Wood	419.80	0.143
Lumber and drill supplies.....	205.24	0.070
Renewals and repairs.....	200.30	0.068
Diamonds, @ \$17.38 per karat.....	898.06	0.307
Fireman	496.21	0.169
Superintendence	1,017.03	0.348
Total	\$3,870.60	\$1.324

For purposes of comparison, samples from actual experience have been procured, showing the cost of boring with Diamond Drills under like circumstances elsewhere. It is true that differences in the cost of labor, transportation, fuel, and especially in the hardness of the rocks through which the borings are made, are likely to make such comparisons of doubtful value, unless these differences are taken into account. Nevertheless, the figures given above for the working of the Government Diamond Drill will, on the whole, compare very favorably with those for operations carried on in other countries under conditions as nearly alike as can be cited. In the *New York Engineering and Mining Journal* of September 22 and 29, 1894, details are given of the cost per foot of boring nine holes on one of the iron ranges in Michigan, the aggregate depth being 2,091 feet. The total cost in this case was \$2.374 per foot, as compared with \$0.986 per foot with the Government drill at Glendower. No particulars are given, however, as to the character of the rock penetrated on the Michigan property. The items at the latter place are as follows:

	Cost Per Foot.
Labor on drill.....	\$0.606
Fireman	0.206
Fuel	0.182
Camp account.....	0.722
Repairs on drill, bits, core-barrels, etc.....	0.126
Repairs on boiler and machinery and sundry supplies....	0.097
Carbons, @ \$17.00 per karat.....	0.239
Superintendence	0.196
Total	\$2.374

In the *Engineering Magazine* for March, 1896, Mr. J. Parke Channing gives details of the cost of boring 18 holes to a total depth of 5,046 feet in iron ore properties at various places in Michigan. His figures are summarized as follows:

	Total Cost.	Cost Per Foot.
Labor on drills.....	\$3,580.27	\$0.709
Firemen	1,387.24	0.275
Chopping wood	1,266.01	0.251
Camp account.....	3,208.44	0.636
Bits and repairs on drills.....	585.47	0.116
Supplies and repairs on machinery.....	440.51	0.088
Carbons, @ \$26.00 per karat.....	1,660.97	0.330
Superintendence	1,006.38	0.199
Total	\$13,141.29	\$2.604

The material encountered in the holes consisted of iron slates, diorite, jasper, quartzite, etc.

In the same article the expense of operations conducted by Mr. E. J. Longyear, of Hibbing, Minn., comprising 21 holes and an aggregate depth of 4,684 feet is given. The figures are as follows:

	Total Cost.	Cost Per Foot.
Labor	\$ 5,569.74	\$1.189
Fuel at boiler	735.97	.157
Camp account	2,416.49	.516
Bits and repairs on drills.....	722.24	.154
Supplies, boiler and pump repairs.....	226.28	.048
Carbons, @ \$26.00 per karat.....	3,201.09	.684
Superintendence	1,211.51	.259
Total	\$14,083.32	\$3.007

The strata passed through consisted of jasper, iron slates, sandstone and marble.

In the East New York mine at Ishpeming, Mich., 28 holes were bored to a depth of 3,746 feet, of which 193 feet were in hematite, 646 feet in jasper, 986 feet in mixed ore, and 1,921 feet in dioritic schist. The record of cost as given by Mr. Channing is as follows:

	Total Cost.	Cost Per Foot.
Labor—400¼ days' setter at \$3.00.....	\$1,200.75	\$0.669
372¼ days' runner at \$2.25.....	837.00	.669
230¼ days' runner at \$2.00.....	460.50	.669
4½ days' laborer at \$1.75...	7.85	.669
Carbon, @ \$16.00 per karat.....	1,035.47	.276
Bits, lifters, shells, barrels and repairs..	433.81	.115
Oil, candles, waste, and supplies.....	128.09	.033
Estimated cost compressed air.....	374.60	.100
	<hr/>	<hr/>
Total	\$4,478.07	\$1.195

Two instances of underground drilling are given in the same article, in both of which the cost was much less than in the operations conducted from the surface. The first is from the records of the Minnesota Iron Company, and covers a period of twenty months, from May 1, 1894, to December 31, 1895:

Number of feet drilled, 13,312.

	Total Cost.	Cost Per Foot.
Carbon, @ \$17.50 per karat.....	\$4,587.82	\$0.340
Supplies and oils	939.84	.070
Fuel	547.39	.400
Shop labor and material.....	679.01	.050
Pay roll	3,694.83	.273
	<hr/>	<hr/>
Total	\$10,448.89	\$0.773

This drilling was all done in the back stopes, almost every foot being in the ore. The drills used were the SULLIVAN make, "E" size, the holes being 1½ inch in diameter, and from 10 to 40 feet deep, the machines being operated by compressed air.

The second instance is from work done at the Cleveland mine, Ishpeming, Mich., in 1892. It consisted of 6,075 ft. of underground drilling and 1,414 ft. of surface drilling, with 470 ft. of standpipe sunk.

	Total Cost.	Cost Per Foot.
Carbon, @ \$17.50 per karat.....	\$1,887.00	\$0.237
Supplies and oils	134.13	.017
Fuel	360.73	.045
Shop material, etc.....	663.36	.083
Pay-roll	4,000.03	.502
	<hr/>	<hr/>
Total	\$7,045.25	\$0.884

The last two tables are given in order to show the cost of exploring for ore bodies in working mines, but they are not strictly comparable with the cost of work done by the Government drill, or with surface operations generally, as the latter embraces items of expense, such as freight and teaming, which are absent in the former case.

NOTE.—The government of New Brunswick also purchased one of our Diamond Prospecting Core Drills, size "H."

Instructions for Setting Diamond Bits

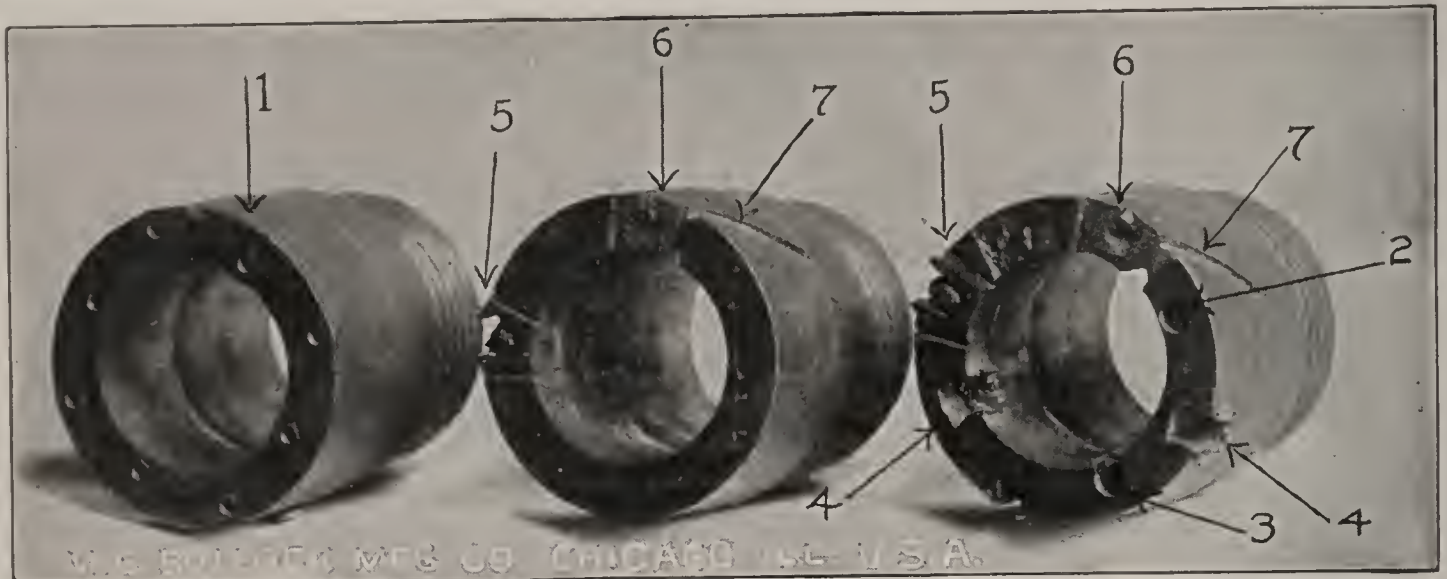


Fig. 27

As a general rule, it may be stated that eight stones should be used for setting a diamond bit. Very large bits are frequently set with more stones, in order to "cover," and sometimes small bits are set with only six stones.

The DIAMONDS should be picked out carefully, with especial attention to their location in the bit and a uniformity of size and weight. This latter point is important, for a small stone set with a number of large ones will become insecure in its setting and necessitate the resetting of the entire bit long before the balance of the stones require it. As a general rule, four of the strongest stones are picked out for the outside stones.

The BIT is laid out as indicated at No. 1 (Fig. 27), for placing four stones on the outside cutting edges and four on the inside. The four outside stones are placed in pairs, on lines at right angles; the lines joining the two pairs of inside stones bisect the angles of these lines. Laid out in this manner and carefully set, the bit will be well balanced and cannot but run smoothly and true.

After selecting a stone for a certain position, a hole is drilled with a twist drill smaller than the stone (See No. 2); then by use of the small chisels and caulking tools, the metal of the bit is chipped away and caulked back to conform as closely as possible to the size and shape of the stone, as shown at Nos. 3 and 4. Especial care should be taken to see that the stone "seats" perfectly and that it is up to gauge on the face of the bit as well as on the side.

Our bit blanks are all made exactly to gauge, and it is therefore safe to take them as a gauge in setting, the stones setting just flush with the face and set with a clearance on the side, as will be required by the nature of the rock.

After the cavity has been properly formed to receive the stone, it is put into place, and by means of the caulking tools and punches the metal of the bit is drawn back around the stone, fastening it firmly. Two heavy chisel cuts are usually made a short distance from the stone across the face of the bit (see No. 5) and these are used as starting points from which to draw the metal over. In caulking the metal over, be careful not to throw the stone out of position, either by crowding it down or to one side, or forcing it too high on the cutting face. A little time exercised on this point when first starting is well spent. Be careful not to strike the diamond with the hammer or the caulking tool; the diamond will stand a very heavy, steady *pressure*, but will be shattered by a very slight *blow*. Caulk the metal in evenly all around the diamond; *i. e.*, do not caulk the metal closely upon one side and then on the other, but work

carefully clear around the stone, bringing the metal together in a body as closely as possible. If the stone is so irregular that in order to get it into place in the bit it is necessary to chip away a large amount of metal, so that there is not sufficient metal to fill in when caulked back, a small piece of copper or horse-shoe nail can be used for filling in and thus leave enough metal to permit of caulking firmly into place.

When setting the inside stones, it is well to take a small piece of tin or sheet iron, bent properly to cover half of the face of the bit, and place it over the stones that have been set opposite the stone being worked on; this will often prevent the breakage of a stone through the slipping of a hammer or tool.

The proper amount of clearance for the stones depends upon the character of the rock. For very hard rocks, which hold together well and are not apt to clog, a clearance of one-sixty-fourth of an inch on each outside stone, making one-thirty-second of an inch on the full diameter, will be found sufficient; but in drilling soft rock one-thirty-second of an inch and frequently more is necessary.

After the diamonds are all set, water grooves should be cut across the face of the bit and down the inside and outside to the counterbore and the shoulder (see No. 7). Be careful to make them ample, so that the drill cuttings can be easily carried away by the flow of water. If the water grooves are not made large enough, the metal of the bit is worn away from the diamonds, and the settings become loose and unsafe before they should.

The bit should be carefully examined each time the rods are pulled, and when the metal shows signs of wear it should be carefully caulked back around the diamonds. This examination sometimes shows that the diamonds do not "cover" the cutting face properly; in such cases it is best to set in a small stone to reinforce the setting for the time being, and when the diamonds are cut out and reset, be careful to see that they "cover."

To cut the stones out after the bit has become worn so that the settings have become unsafe, take a hack saw or file and cut across the face of the bit close to the stone and drive the metal away from it and chip it away until the stone is released.

The Tools necessary for diamond setting are one set of the small chisels and caulking tools, a light hammer, a bit holder (in which to hold the bit blank), a small vise and one or two files. They are always furnished with our large Diamond Drill outfits.

Price List, Special Diamond Drill Tools and Supplies

Following are the price lists of our special makes of casing, drilling tools, recovering taps, etc. The prices on all these goods are net, with *no discount*.

In examining these lists it should be borne in mind that—(usually) "C," "H," "H G" and "R H" drills use "A" rods, bits, shells, core barrels, taps, etc.

"B" drills use "B" rods, bits, shells, core barrels, taps, etc.

"E," "M," "R," "R S" and "S" drills use "E" rods, bits, shells, core barrels, taps, etc.

"N," "H N" and "P" drills use "N" rods, bits, shells, core barrels, taps, etc.

Fittings for "K" drills are Special. (See page 38.) Prices for same quoted on application.

Price List (Continued)

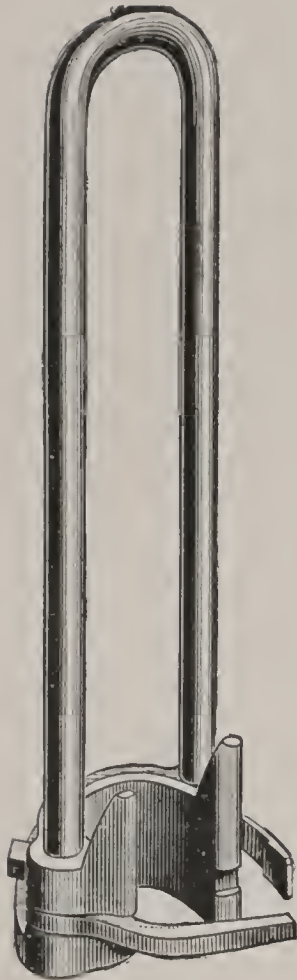


Fig. 28.

Lifting-Bail and Clevis.

The letters used for rods, bits, core barrels, etc., indicate the size of these fittings—"A" for $1\frac{13}{16}$ inch hole, $1\frac{1}{8}$ inch core; "B" for $2\frac{1}{16}$ inch hole, $1\frac{3}{8}$ inch core; "E" for $1\frac{9}{16}$ inch hole, $\frac{15}{16}$ inch core; "N" for $2\frac{13}{16}$ inch hole, 2 inch core. Several styles of each size are made, as will be noted in price lists of core shells, core lifters, etc., below.

In cases where circumstances make it advisable to use larger or smaller fittings than those given in the above list or in the description of the drills, the change can be readily made.

The size of the hole and core can be increased by substituting larger core barrels, lifters, shells and bits. To increase the size of hole, the rods as well as core barrels, bits, etc., require changing. In very hard rock the smaller the hole the less the cost of the work and the better the rate of progress, while the accuracy of the test is the same. Thus in drilling for iron ore the "E" fittings are frequently used on the "C," "H" and "B" drills. While in testing for softer mineral, like salt or coal, it is advisable to remove larger core and the "N" fittings are frequently used on the "H" and "C" drills. The "M" drill can use either "E" or "A" bit and other fittings, according as its work is to be in hard or soft formations.

Bail and Clevis

Size of rods.....	A	B	E	N	P
Price each, consisting of					
Bail and Clevis.....	\$3.50	\$4.00	\$3.50	\$5.00	\$6.25
Code word.....	{ Abisontes	Abissammo	Abissassi		
		Abispado	Abissando		

Blank Bits (in which diamonds are set).

Size.....	A	B	E	N
Diameter, inches.....	$1\frac{3}{4}$	2	$1\frac{1}{2}$	$2\frac{3}{4}$
Price, per dozen.....	\$15.00	\$15.00	\$12.00	\$21.00
Code word.....	{ Abissato	Abissava	Abissavamo	Abominant



Fig. 29.

Diamond Bit.

Casing Bits (for Flush Coupling Casing)

Size of casing.....	E	2 in.	$2\frac{1}{2}$ in.	3 in.	$3\frac{1}{2}$ in.	4 in.
Price, each.....	\$2.50	\$3.00	\$4.00	\$4.75	\$5.25	\$5.50
Code word.....	{ Abominatio	Abominatos	Abominava	Abominosas	Abonable	Abonaron

Price List (Continued)

Chopping Bits (with single cutting edge)

In ordering, give size of wash pipe the bit is to be screwed into, or diameter of screw and number of threads to inch, as well as length of cutting edge of bit.

Length of cutting edge, inches	2 ³ / ₄	3 ³ / ₈	3 ⁷ / ₈	4 ³ / ₈	4 ⁷ / ₈	5 ⁷ / ₈	7 ⁷ / ₈
Used inside Drive Pipe or Casing of nominal inside diameter, inches	3	3 ¹ / ₂	4	4 ¹ / ₂	5	6	8
Price, each	\$5.75	\$6.50	\$7.00	\$7.50	\$8.00	\$10.00	\$15.00
Code word	Abondait	Abondance	Abondasse	Abonnennten	Aboon	Abopus	Aboque

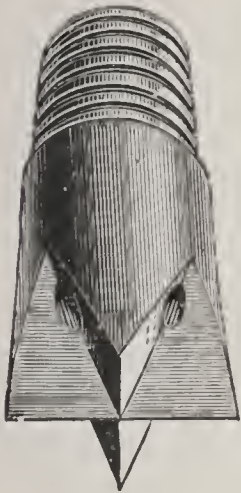


Fig. 30. Cross Chopping Bit.

Chopping Bits, with two crossed cutting edges (threaded for Drill Rods)

Size of Drill Rods	A	B	E	N
Length, cutting edge, in...	1 ³ / ₄	2	1 ¹ / ₂	2 ³ / ₄
Price, each	\$6.25	\$7.50	\$5.00	\$10.00
Code word	Abouquillar	Abouquillo	Aboral	Abordaba

Bushings from Drill Rods to Casing.

Any size Rods.							
Dia. of Casing	E	2 in.	2 ¹ / ₂ in.	3 in.	3 ¹ / ₂ in.	4 in.	4 ¹ / ₂ in.
Price, each	\$3.00	\$3.00	\$3.50	\$4.00	\$4.50	\$5.00	\$5.50
Code word	Abordable	Abordador	Abordagem	Acajou	Acaiefos	Acala	Acaleph

Carbon or Diamonds (for drilling or reaming)

On account of the continual variation in the price of carbon the figure covering this item, as shown in the tables of complete estimates, is to be taken merely as an average price.

We carry a large stock of carefully selected stones, and, upon application, will quote the lowest market rates.

Flush Coupling Casing

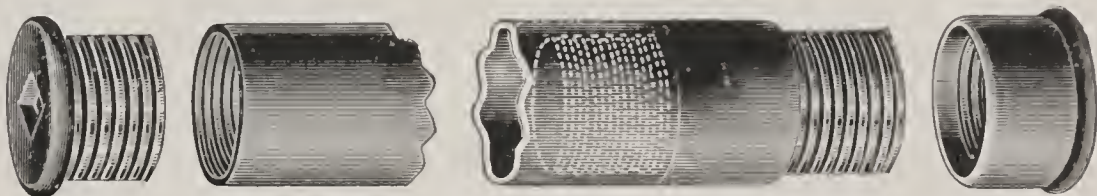


Fig. 31. Flush Coupling Casing and Protectors.

This casing has perfectly smooth joints, the absence of outside couplings reducing the amount of reaming necessary, and leaving no projecting parts liable to catch in inserting or pulling out the casing. It is made of steel pipe, threaded in a lathe, and is strong and durable, and excellent in every way. Casing over 2 inches is threaded *left hand* to prevent it unscrewing from the bottom in soft formations by the rotation of the drill rods; and also in case of becoming fast it can be "backed off" by the drill rods and a right hand tap. Two-inch casing is *right hand*, to allow it to be drilled into the rock with a casing bit when necessary.

Price List (Continued)

Flush Coupling Casing

Nominal Inside Diameter, Inches	Actual Inside Diameter Coupli'g, Inches	Actual Outside Diameter, Inches	Weight per Foot	Lengths about 10 Feet		Lengths about 5 Feet	
				Price per Foot	Code Word	Price per Foot	Code Word
E 1 5/8	1.62	2.12	3.0 lbs.	\$.65	Acalical	\$.75	Acalyphe
2	1.93	2.37	3.4 "	.45	Acallas	.60	Acamacu
2 1/2	2.31	2.87	5.6 "	.75	Acallo	.90	Acamata
3	2.89	3.50	6.5 "	.95	Acalot	1.20	Acampar
3 1/2	3.35	4.00	8.5 "	1.20	Acalotes	1.45	Acamptos
4	3.81	4.50	10.3 "	1.35	Acalotto	1.60	Acandilo

Casing Thread Protectors for Flush Coupling Casing

Size of Pipe.....	E	2 in.	2 1/2 in.	3 in.	3 1/2 in.	4 in.
Price per pair.....	\$.50	\$.50	\$.50	\$.60	\$.70	\$.80
Code word	Acanga	Acaniens	Acanite	Acansas	Acantha	Acantile

Chucks: Drive Chucks

Size of Drill	Price Complete	Code Word	Price Extra Jaws Each	Code Word
"B"	\$25.00	Actinique	\$3.00	Actiosus
"C" "H" "RH" "HG" ..	15.00	Actinism	3.00	Actisanes
"E" "R" "RS" "S" ...	12.00	Actinosos	3.00	Actitud
"N" "HN" "CN"	30.00	Actinote	3.00	Activaba
"P"	45.00	Actionne	5.00	Activais
"Detector"	25.00	Xactinique	3.00	Xactiosus
"Champion"	15.00	Xactinism	3.00	Xactisanes
"Beauty"	} 12.00	Xactinosos	3.00	Xactitud
"Bravo"		Xactinote	3.00	Xactivaba
"Badger"		Xactionne	3.00	Xactivais

Clamps: Pipe Clamps

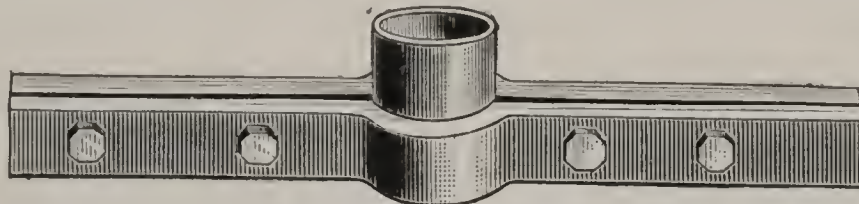


Fig. 32. Pipe Clamp.

Size of Pipe, inches,	2	2 1/2	3	3 1/2	4	4 1/2	5	5 1/2	6
With bolts and nuts,	\$4.00	\$4.50	\$6.00	\$6.00	\$8.00	\$8.00	\$8.50	\$8.50	\$9.00
Code word.....	{ Aithalis		Aitonie		Aiulado		Albaquia		Albarca
		Aitiology		Aiuga		Albanum		Albaras	

Price List (Continued)

Clamps: Safety Clamps

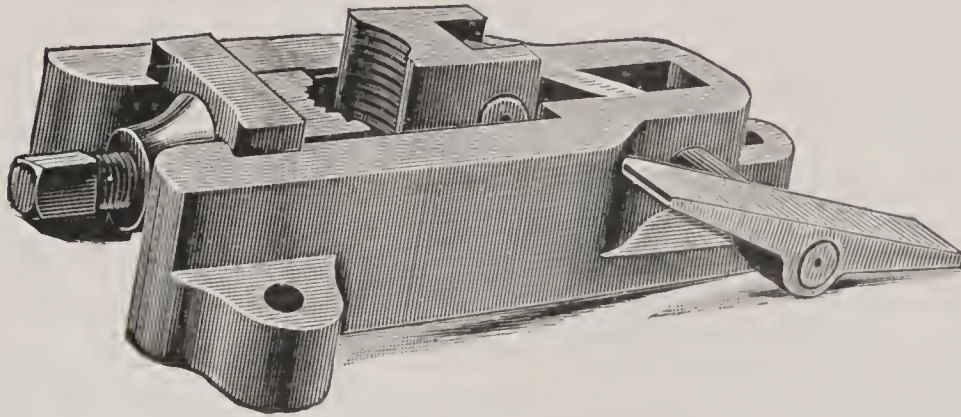


Fig. 33. Safety Clamp.

Size of Drill	Complete Each	Code Word	Extra Jaws Station'ry	Code Word	Extra Jaws Swinging	Code Word
"B" "Detector"	\$50.00	Activar	\$7.50	Actuation	\$20.00	Adigimur
"RH" "HG" "C" } "H" "Champion" } "E" "R" "RS" "S" }	17.00	Activos	3.15	Actuator	5.00	Adikara
"Beauty" "Bravo" } "Badger" }	17.00	Activum	3.15	Actuo	5.00	Adikos
"M" "HN" "CN"	17.00	Actorium	3.15	Actuosi	5.00	Adimam
"N"	50.00	Actuaban	7.50	Actuosos	20.00	Adimando
"P"	70.00	Actuamos	9.25	Adigege	25.00	Adimassi

Clevis (See Bail and Clevis, page 85.)

Core Barrels

Size of Bit	10-foot Length	Code Word	5-foot Length	Code Word	20-inch Length	Code Word
"A"	\$14.00	Adimava	\$11.00	Adindam	\$ 8.00	Adinsurgo
"B"	20.00	Adimini	15.00	Adinditae	10.00	Adipalem
"E"	12.50	Adimonia	10.00	Adinola	7.00	Adipalis
"N"	37.50	Adinamo	24.00	Adinstar	16.50	Adipatae

Core Barrels (spiral)

Size	1¾ in.	1¾ in.	2 in.	2½ in.	Code Word
Core Barrels, spiral, 5 ft. long	\$20.00	\$28.00	\$30.00	.....	Adolin
Core Barrels, spiral, 8 ft. long	30.00	42.00	47.00	.....	Adomu
Core Barrels, spiral, 10 ft. long	34.00	47.00	52.00	\$60.00	Adodo
Core Barrels, spiral, 12 ft. long	.....	52.00	57.00	65.00	Adosit
Core Barrels, spiral, 16 ft. long	.....	.....	.....	75.00	Adorul

Price List (Continued)

Double Tube Core Barrels

"N" Double Tube Core Barrel with Lifter, Bit and Extension, complete\$135.00
 Code Word Advolt
 Core Barrel, complete but less extension..... 100.00
 These Core Barrels can be used on H N, C N, N, P, P K, and K. Drills.
 Code word Advaxt

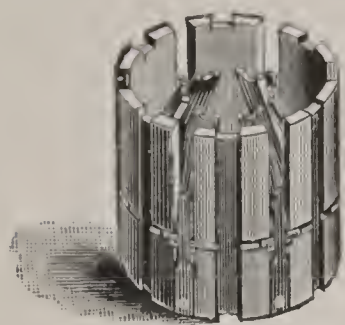


Fig. 34.
Cossette Core Lifter

Core Lifters "Cossette" (for straight shell) with Loose Jaw and Steel Spring

Size	Each	Code Word	Extra Jaws Each	Code Word	Extra Springs Each	Code Word
"A"	\$3.80	Adipatos	\$0.25	Advelatos	\$0.06	Advenais
"B"	3.80	Adipeux	.25	Advelavi	.06	Advenant
"N"	6.25	Advelatae	.25	Advelo	.06	Advenons

Core Lifters, Spring Steel, (for Straight Shell) for "E" fittings

Specially Designed for the small "E" Core. Price each.....\$1.00
 Code word Adventae

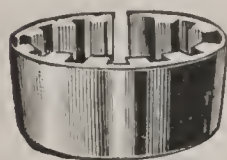


Fig. 35. Taper Split Ring Core Lifter.

Core Lifters, Taper Split Ring Core Lifters (for Bevel Shell)

Size	"A"	"B"	"E"	"N"
Price each	\$3.15	\$3.15	\$2.50	\$3.15
Code word	Advientos	Advinmes	Advixi	Advixisti

Core Shells

Size	Straight Shell for "Cossette" and Upright Core Lifters	Code Word	Bevel Shell for Taper Split Ring Core Lifters	Code Word
"A"	\$3.25 each	Advokes	\$5.00 each	Advorsum
"B"	3.25 "	Advolent	5.00 "	Advowee
"E"	3.25 "	Advorsae	5.00 "	Advowson
"N"	5.00 "	Advorsos	5.00 "	Afetende

Drive Blocks (Cast Iron). When necessary the heavy block can be shipped in sections.

For driving Stand Pipe, with Lifting Clevis and Guide Bolts.
 Light Block, 250 lbs., for drills up to, and including, size "S," and for "Badger" and "Beauty," price..... \$10.00
 Heavy Block, 570 lbs., for all larger Drills, price..... 17.00
 Code word, Light Block.....Affalex
 Code word, Heavy Block.....Affund

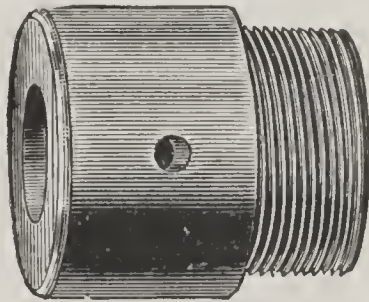
Price List (Continued)

Drill Rods with Couplings

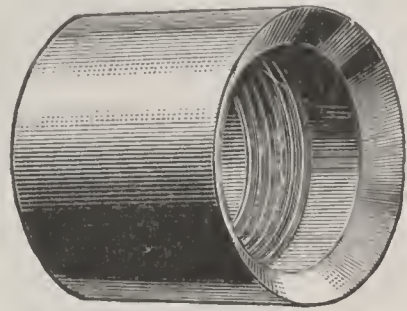
Size	Outside Diameter Inches	Length Feet	Weight 100 Feet Boxed	Price 100 Feet	Code Word	Extra Couplings Each	Code Word
"A"	1 $\frac{5}{8}$	10	370	\$ 80.00	Affabilis	\$1.25	Affaisses
"B"	1 $\frac{15}{16}$	10	450	85.00	Affabrae	1.25	Affaitato
"E"	1 $\frac{5}{16}$	5	385	75.00	Affabrum	1.00	Affaitava
"E"	1 $\frac{5}{16}$	10	385	65.00	Affagotta	1.00	
"N"	2 $\frac{3}{8}$	10	650	100.00	Affaibli	1.50	Affaito

Note: "A" Rods are used with "C," "R H," "H G," "H" and "Champion" Drills; "B" Rods are used with "B" and "Detector" Drills; "E" Rods are used with "E," "M," "R," "R S," "S," "Beauty," "Bravo" and "Badger" Drills; "N" Rods are used with "N," "H N," "C N" and "P" Drills. Prices on larger rods furnished on application.

Drive-Heads and Shoes



Drive-Head.



Drive-Shoe.

Fig. 36.

Size Pipe	Price, Head or Shoe	Code Word for Head	Code Word for Shoe
2 -inch	\$ 5.00	Affamissi	Afwaarts
2 $\frac{1}{2}$ -inch	6.00	Affandos	Afweeken
3 -inch	7.00	Affandum	Afwelven
3 $\frac{1}{2}$ -inch	8.00	Affangato	Afwoelen
4 -inch	10.00	Affangava	Afwrikken
4 $\frac{1}{2}$ -inch	11.00	Affanghi	Agaat
5 -inch	12.00	Affango	Agabus
6 -inch	15.00	Affannoso	Agacais
8 -inch ..	20.00	Affarino	Agacasses

Drive Pipe, (for specifications see page 95)

Hoisting Plugs or Lifting Swivels

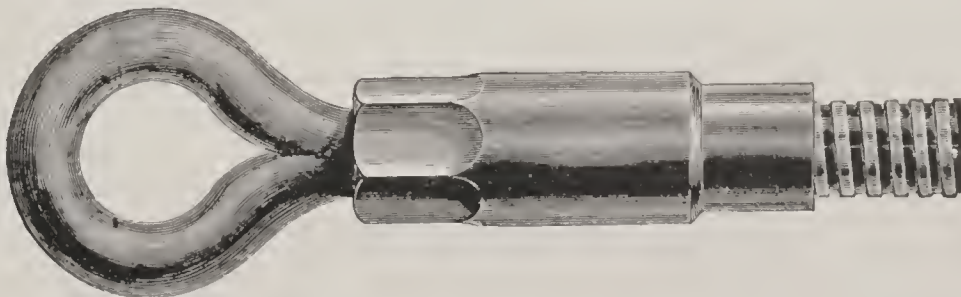


Fig. 37. Hoisting Plug or Lifting Swivel.

Size of rods	A	B	E	N
Price each	\$8.00	\$8.00	\$6.00	\$12.00
Code word	Agafita	Agagam	Agagarum	Agagis

Price List (Continued)

Hoist for "M" and "Bravo" Drills (see page 17)

Price complete with rope and hook..... \$35.00
Code word Agacho

Horse Powers

By means of a Horse Power the "M" and "Bravo" Drills can be used to a depth of 400 or 500 feet.

Price of Horse Power, including Jack, two Pulleys and Belting.... \$60.00
Code word Agagulae

Lifting Swivels (see Hoisting Plugs)

Reamers

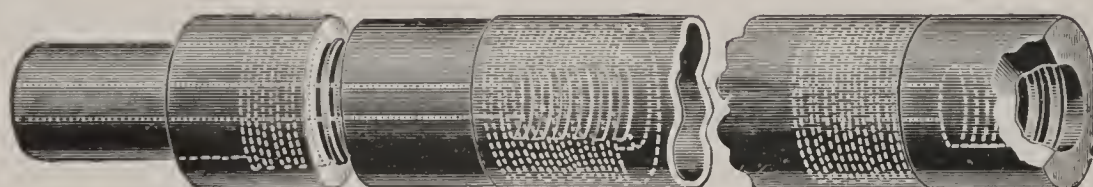


Fig. 38. Reamer.

Size of Casing to be Inserted	Long Reamer Complete, but Without Diamonds	Code Word	Extra Faces, Each	Code Word
E	\$22.00	Agaul	\$2.50	Agona
2 in.	22.00	Agagulis	2.50	Agonatos
2½ "	24.00	Agalactia	2.50	Agonaux
3 "	28.00	Agalassa	3.00	Agonicae
3½ "	33.00	Agallattia	3.50	Agonicliti
4 "	38.00	Agalaxie	4.00	Agonicos

Besides the above, we make other styles adapted for use in special cases. We can furnish any of these promptly, from stock or to order, and will give prices on application. In ordering *be sure to specify* size of guide, size and kind of casing to be inserted, and size of drill rods to be used with reamer.

Setting Blocks (for holding Blank Bits while setting the diamonds)

Size	A	B	E	N
Price each	\$1.25	\$1.25	\$1.25	\$1.25
Code word.....	Agonicum	Agonisant	Agonism	Agonoteta

Sheave Wheels (with Strap and Hook)

Size of Drill	Champion, Beauty, C, H	B Detector	Bravo, Badger, E, M, R, RS, S	N	P
Diam. of Sheave, in..	24	36	13	36	42
Price, complete	\$10.25	\$17.50	\$7.50	\$17.50	\$30.00
Code word.....	Agonrais	Agonus	Agoraba	Agorabais	Agoranax

Price List (Continued)

Taps, Rod Recovering Taps (Right or Left Hand)



Fig. 39. Rod Recovering Tap.

Size Rods	A	B	E	N
Price each	\$13.00	\$13.00	\$11.00	\$17.00
Code word	Agoranis	Agorgojo	Agosidad	Agostando

Made of special tool steel, and properly tempered. In ordering Taps, state size of rods or casing to be pulled and kinds of thread on rods or casing by which the Tap is to be lowered, also whether the right or left hand tap is required.

Coupling Taps (right or left hand)

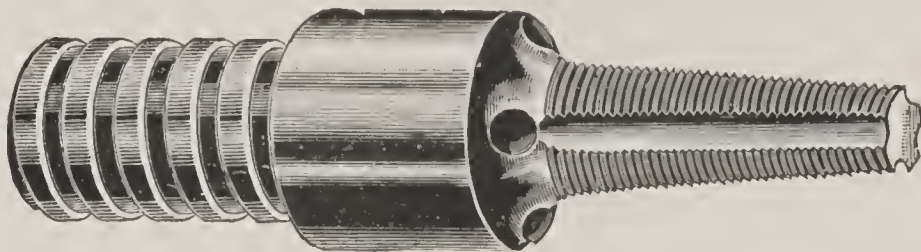


Fig. 40. Coupling Recovering Tap.

Size couplings	A	B	E	N
Price each	\$5.00	\$6.00	\$4.00	\$8.00
Code word	Agostasse	Agostava	Agostinha	Aisement

Hollow Taps (right or left hand)

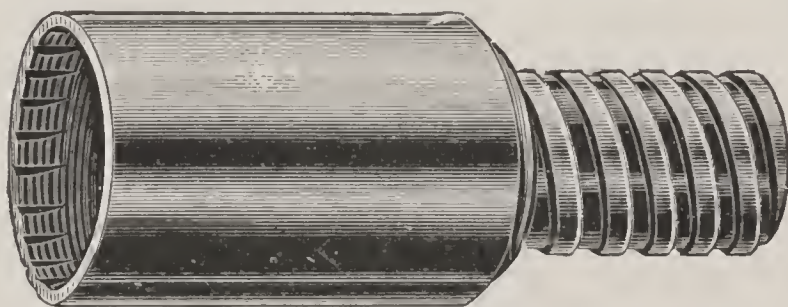


Fig. 41. Hollow Tap.

Size rods	A	B	E	N
Price each	\$11.00	\$11.00	\$10.00	\$12.00
Code word	Aislables	Aislados	Aislarian	Aisled

Casing Recovering Taps (Taper, same as Taper Rod Recovering Tap)

Size casing, right or left hand	2-in.	2½-in.	3-in.	3½-in.	4-in.
Price each	\$15.00	\$20.00	\$25.00	\$30.00	\$35.00
Code word	Aislo	Aismabas	Aismais	Aismaseis	Aismasen

Price List (Continued)

Water Swivels (common)



Fig. 42. Common Water Swivel.

Size of rods.....	A	B	E
Price each.....	\$10.00	\$12.00	\$8.00
Code word.....	Aissade	Aissaugue	Aistulf

Water Swivels (improved, with Friction Ball Bearings)

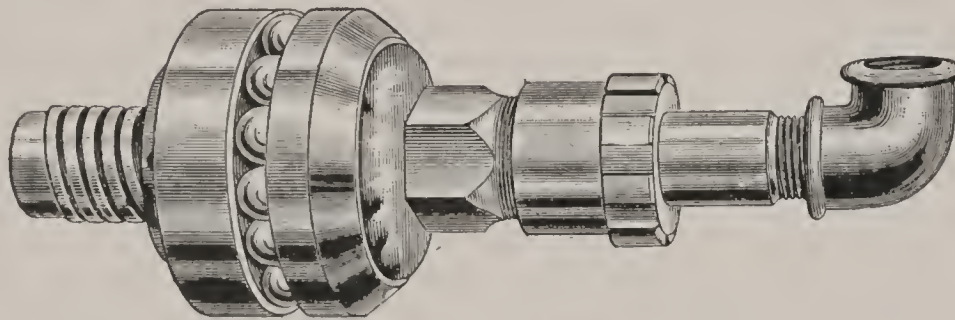


Fig. 43. Improved Water Swivel.

Size of rods.....	A	B	N
Price each.....	\$20.00	\$20.00	\$40.00
Code word.....	Aitchbone	Aitemona	Aithalem

Special Water Swivel (with Hoisting Swivel combined)

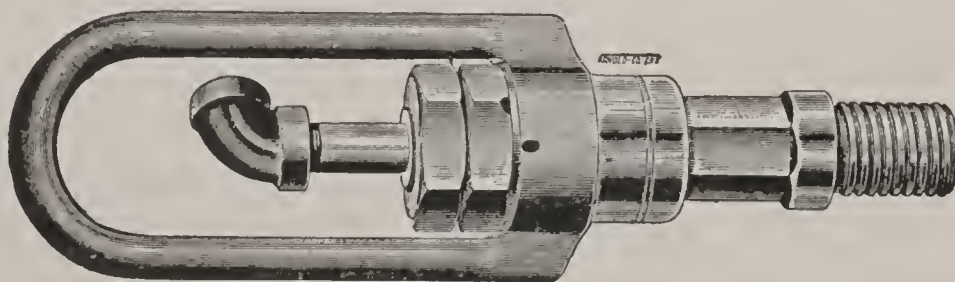


Fig. 44. Special Water Swivel

Size of rods.....	A	B	E	N
Price each.....	\$16.50	\$17.50	\$10.00	\$32.50
Code word.....	Aislam	Aislar	Aislac	Aislab

Drive Pipe with Special Long Threads and Patent Couplings

In pieces about 10 feet long, threaded so that ends of pipe butt together when screwed up. Common pipe can be used for drive pipe where the depth is not too great; but it will not stand such severe usage as the special drive pipe.

Nominal Inside Diam., Inches	Actual Inside Diam., Inches	Outside Diameter, Inches	Diameter of Coupling, Inches	Weight per Foot, Lbs.	Threads to Inch
3	3.06	3.50	4 ⁷ / ₃₂	7.54	8
3½	3.56	4.00	4 ¹¹ / ₁₆	9.00	8
4	4.02	4.50	5 ³ / ₃₂	10.66	8
4½	4.50	5.00	5 ²⁵ / ₃₂	12.34	8
5	5.04	5.56	6 ¹ / ₃₂	14.50	8
6	6.06	6.62	7 ¹³ / ₃₂	18.76	8
7	7.02	7.62	8 ¹ / ₃₂	23.27	8
8	7.98	8.62	9 ¹ / ₃₂	28.18	8

Net Prices given on application.

Lap and Butt-Welded Wrought Iron Pipe

	Nominal Inside Diameter, Inches	Actual Inside Diameter, Inches	Thickness, Inches	Outside Diameter, Inches	Diameter of Coupling, Inches	Weight per Foot, Lbs.	Number Threads to Inch	Price per Foot
Butt-Welded.	1/8	.27	.07	.40	.60	.24	27	\$0.05½
	1/4	.36	.08	.54	.78	.42	18	.05½
	3/8	.49	.09	.67	.91	.56	18	.05½
	1/2	.62	.10	.84	1.10	.85	14	.08½
	3/4	.82	.11	1.05	1.34	1.12	14	.11½
	1	1.04	.13	1.31	1.66	1.67	11½	.16½
	1¼	1.38	.14	1.66	2.00	2.24	11½	.22½
Lap-Welded.	1½	1.61	.14	1.9	2.28	2.68	11½	.27
	2	2.06	.15	2.37	2.81	3.61	11½	.36
	2½	2.46	.20	2.87	3.28	5.74	8	.57½
	3	3.06	.21	3.5	4.02	7.54	8	.75½
	3½	3.56	.22	4.0	4.50	9.00	8	.95
	4	4.02	.23	4.5	5.10	10.66	8	1.08
	4½	4.50	.24	5.0	5.53	12.34	8	1.30
	5	5.04	.25	5.56	6.25	14.50	8	1.45
	6	6.06	.28	6.62	7.34	18.76	8	1.88
	7	7.02	.30	7.62	8.34	23.27	8	2.35
	8	7.98	.32	8.62	9.44	28.18	8	2.82
	9	9.00	.34	9.68	10.47	33.70	8	3.40
10	10.01	.36	10.75	11.50	40.00	8	4.25	
11	11.00	.37	11.75	.....	45.00	8	4.75	
12	12.00	.37	12.75	13.78	49.00	8	5.20	

Discount.....

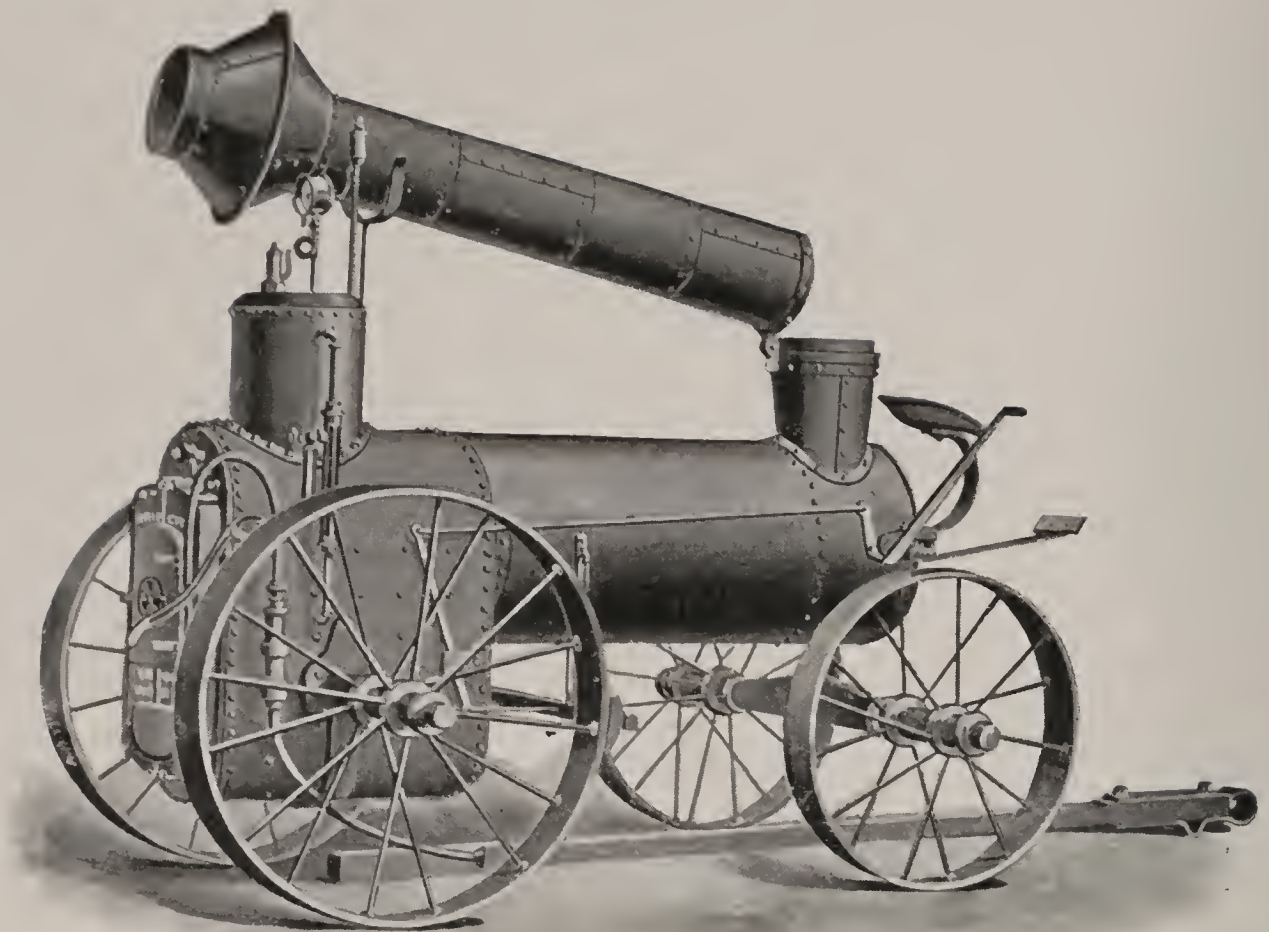


Fig. 45.

Portable Boilers Mounted on Wheels

These boilers are the favorite "Water Bottom" style, with large steel furnace, with fusible plug in crown sheet, and large water space around the fire, giving free circulation of the water and easy access for cleaning. Our price includes grates, steam gauge, water gauge fitted with stand-pipe, gauge-cocks, whistle and pipe, safety-valve, blow-off valve, check and stop valve, smokestack and guys; also the tongue, neck-yoke, evener, whiffletrees, brake and inspirator fitted to boiler.

These boilers are all tested and inspected before shipment by a responsible Steam Boiler Inspection and Insurance Company, at 150 pounds hydrostatic pressure per square inch, and the purchaser can have a certificate of inspection and a policy of insurance for one year issued by the Insurance Company. This policy is payable to the purchaser, and will be in force and valid wherever the boiler is located.

Specifications of Portable Steel Boilers, Mounted on Wheels

HORSE POWER	6	8	10	12	15	20	25	30	35	40	50	50	60	60	70
Diameter of Boiler, inches . . .	26	28	30	32	32	34	36	36	40	40	40	44	44	48	48
Length of Firebox, inches . . .	34	36	38	38	44	52	52	52	52	60	60	64	64	64	64
Width of Firebox, inches . . .	21	22	24	26	26	28	30	30	34	34	34	38	38	42	42
Height of Firebox, inches . . .	29	32	34	38	38	38	40	40	44	44	44	50	50	52	52
Number of 3-in. Tubes	17	18	22	26	26	30	34	34	40	42	42	48	48	52	52
Length of Tubes, inches	54	60	72	72	78	90	96	102	102	120	144	132	144	144	168
Estimated Weight	3,100	3,400	4,000	4,500	4,900	6,000	7,000	7,500	8,200	9,100	10,000	11,000	11,500	12,500	13,300
Code word	{ Alberdais	{ Albereque	{ Albarillos	{ Albarium	{ Albarran	{ Albasch	{ Albasten	{ Albatrico	{ Albatrino	{ Albatross	{ Albebas	{ Alburd	{ Albebit	{ Albindy	{ Albitx

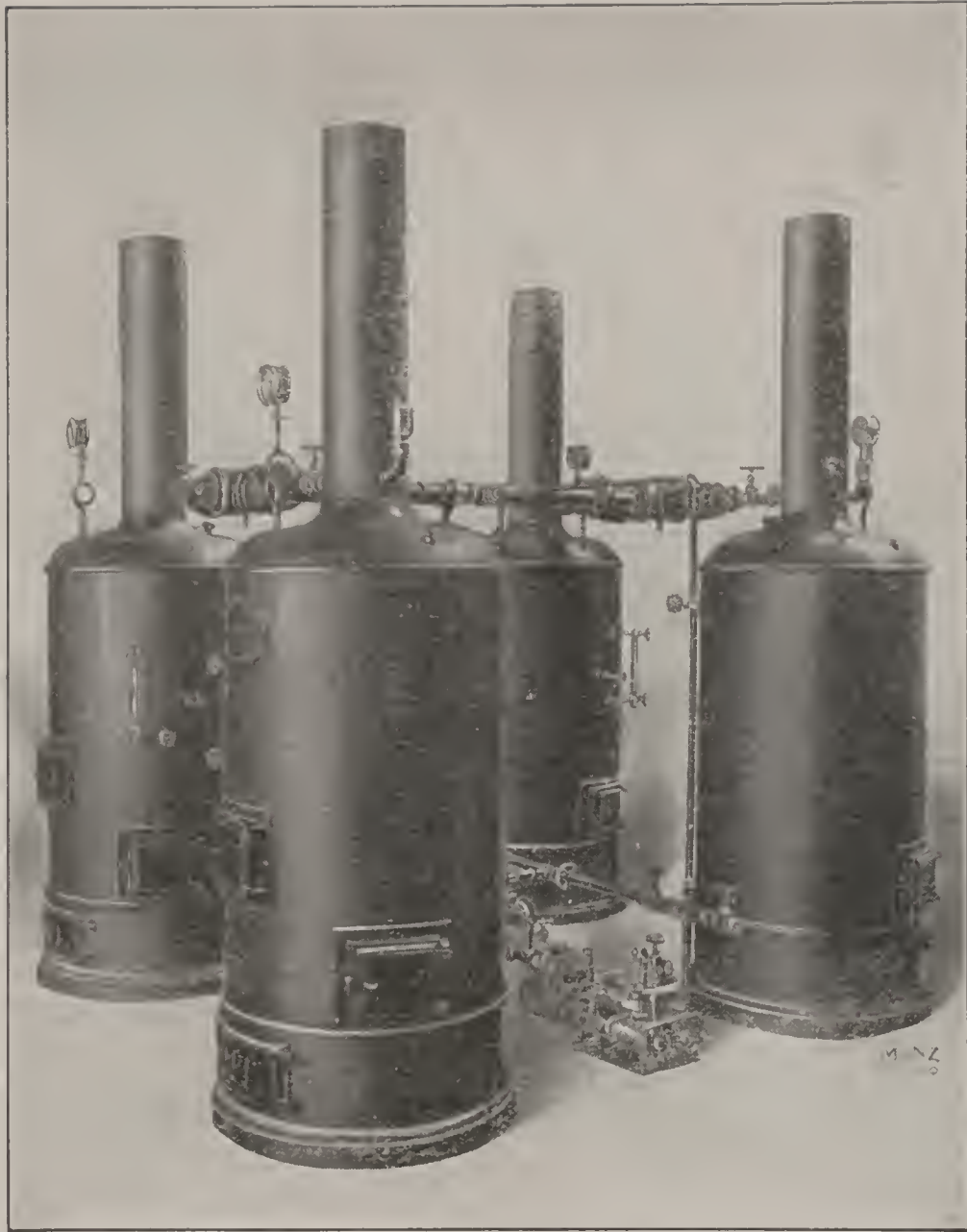


Fig. 46. Showing method of connecting a battery of four boilers.

The "Sullivan" Sectional Safety Boiler Four Horsepower

This boiler is used in connection with our Diamond Prospecting Drills in districts where the outfit must be carried on mule-back or by hand. It is built in sections consisting of hollow cast-iron rings, surrounded by a wrought-iron shell, bolted together by bolts passing through bosses where the rings come in contact with each other. The water passes from one ring to another through these bosses, and should any crack develop in a ring it acts as a safety valve for the steam, preventing an explosion.

“Sullivan” Sectional Safety Boiler (Continued)

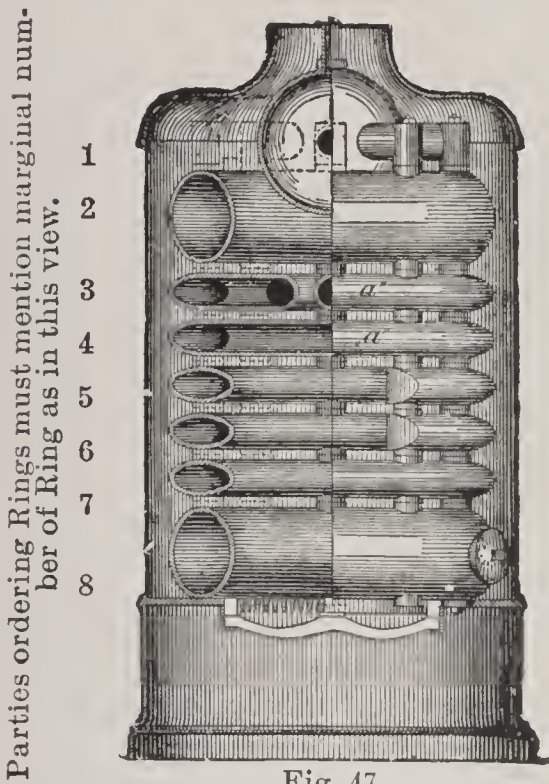


Fig. 47.

When steam capacity greater than four-horse power is required, the boilers are made up into batteries, and thus sufficient steam can be generated to operate any of our core drills. Fig. 47 represents a battery of four Sullivan Sectional Safety Boilers, with a capacity of sixteen-horse power, which is all that is necessary for our size “B” Diamond Core Drill. For “C” drill a battery of three boilers would be required, and so on for the other machines.

Dimensions and Weights

Diameter, inches	30
Height, inches	58
Weight of heaviest piece, lbs.....	135
Total weight, lbs.....	1,200
Price f. o. b. cars.....	\$165.00
Code word	Alimodi

Special Duplex Steam Pumps for Boiler Feeding, Drilling, and General Mining Purposes. Duplex “Piston” Pattern

These pumps are fitted with perfect water pistons of iron or brass, as may be required, operating in brass-lined cylinders. The water valves are of brass or hard composition, and are controlled by brass cylindrical springs, held in place by guards of the same material. The above sizes have been selected as being best proportioned for diamond drill service.

For “K” and “P” Drills we recommend the $7\frac{1}{2} \times 4\frac{1}{2} \times 10$ Duplex Pump.

For “B,” “C,” “N,” “Detector,” “H N” and “C N” Drills we recommend the $6 \times 4 \times 6$ Duplex Pump.

For “E,” “H,” “S” and “Champion” Drills we recommend the Special $4\frac{1}{2} \times 2\frac{3}{4} \times 4$ Pump.

Pumps for “R,” “M” and “Bravo” Drills are included in the equipment as per pages 49 and 124.

For “R S” and “R H” Drills we recommend the 3×3 Triplex Electric Pump.

Special Duplex Steam Pumps (Continued)

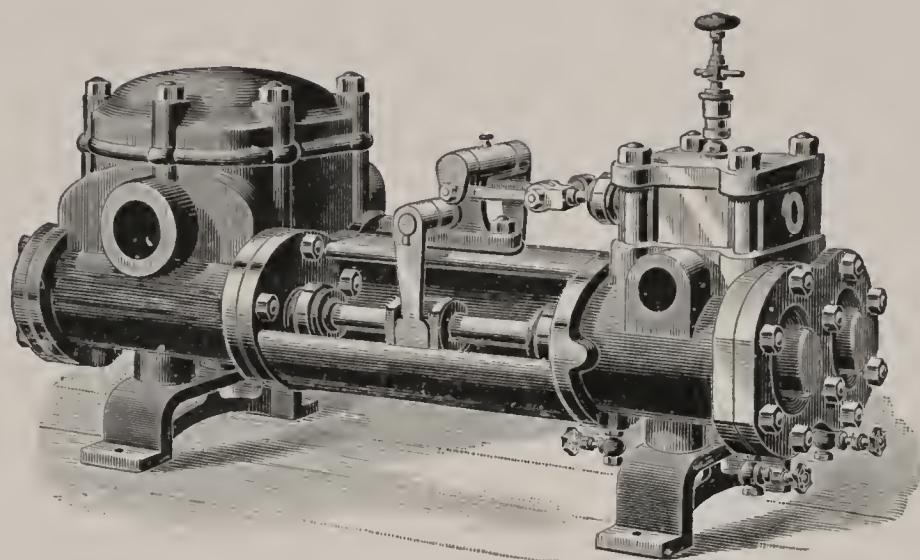


Fig. 48. Working Pressure 150 Pounds.

Diameter of Steam Cylinders, Inches	Diameter of Water Pistons, Inches	Stroke, Inches	Diam. of Piston Required in Single Cylinder Pump to Give Same Discharge at Same Speed, In.	Sizes of Pipe				Weight, Pounds	Price	Extra for Brass Fittings	Code Word
				Steam	Exhaust	Suction	Discharge				
3	2	3	3	$\frac{3}{8}$	$\frac{1}{2}$	$1\frac{1}{4}$	1	130	\$ 50.00	\$ 1.50	Alliniant
$4\frac{1}{2}$	$2\frac{3}{4}$	4	4	$\frac{1}{2}$	$\frac{3}{4}$	2	$1\frac{1}{2}$	260	80.00	5.25	Allinires
6	4	6	$5\frac{5}{8}$	1	$1\frac{1}{2}$	3	2	540	125.00	9.00	Allions
$7\frac{1}{2}$	$4\frac{1}{2}$	6	$6\frac{3}{8}$	$1\frac{1}{2}$	2	4	3	780	175.00	14.00	Alliphae
$7\frac{1}{2}$	$4\frac{1}{2}$	10	$6\frac{3}{8}$	$1\frac{1}{2}$	2	4	3	1,000	300.00	25.00	Alliphis

Patent Sectional All-Metal Derricks, Made in Two Styles — Tripod and Four-Legged.

These derricks are constructed entirely of iron and steel and hence are practically indestructible. The several sections of each leg are fastened together by clamp joints, no pipe threads being used, the cross-pieces and tie-rods cut accurately to length and requiring no adjustment during erection. Steel castings and heavy steel pipe stock are used throughout, and the cross-pieces are braced internally, giving the maximum strength for the weight of material used. The bent-joints are made of steel castings, and all other parts are of regular stock that can be procured in any market, so that in case of breakage repairs can be made without having to send to our factory.

On account of their light weight there is a considerable saving over the old style timber derricks in the item of transportation, and as they

can be dismantled so that no piece weighs over 120 pounds they can be packed on muleback and taken to points to which it would be impossible to transport heavy timber derricks. The light weight of the several pieces facilitates erection, two men only being required for this work and a ginpole is dispensed with.

For ordinary work the "tripod" or three-legged derrick is used, the same as shown in Fig. 49. This style is made up to 60 feet in height to handle a total load of 20,000 pounds. For very deep work the four-legged derrick, constructed on the same general lines as the three-legged, is recommended. This is designed especially for carrying heavy counterweights, provision being made for hanging any desired number of sheave wheels in the derrick head and using our system of multiple roller-bearing counter-balances.

Foundation timbers for derricks are not furnished unless specially ordered. When desired they are cut to exact lengths, all bolt-holes drilled, and the necessary bolts supplied for fastening them together. Before being laid they should be creosoted or coated with tar. Special derrick foundations made of structural iron can be supplied on order, and are recommended for use in localities where wood rots quickly.

The standard sizes of derricks given in the following table are carried in stock for prompt delivery. For special purposes we can furnish other sizes, and all information as to prices and weights will be given upon receipt of information as to requirements.

Height	Number of Legs	Distance Bet. Leg Bases, Feet	Will Hoist in the Clear, Feet	Safe Working Load	SHIPPING WEIGHTS			PRICE	
					Derrick Only	Wooden Foundations	Total	Derrick Only	Derrick with Wooden Foundations
30	3	10	24	4,000	1,500	750	2,250	\$ 125	\$145
38 light	3	12	32	5,000	1,900	900	2,800	175	200
38 heavy	3	12	32	10,000	2,300	1,000	3,300	220	260
52	3	16	45	15,000	4,100	1,200	5,300	350	400
63	3	19	55	20,000	5,400	1,500	6,900	425	500
52	4	16	45	18,000	5,500	1,600	7,100	470	545
63	4	19	55	24,000	7,000	2,000	9,000	575	675
77	4	22	67	40,000	20,000	.....	.....	1,800	.....

Price of derrick includes eyebolt in top casting but does not include sheave wheel.

Price of foundations includes bolts, nuts and washers, and foot plates or sockets for derrick legs.

Foundations for the 77 ft. 4 pole derrick should be of steel.



Fig. 49.

Patent Sectional All Metal Derrick

PART II

Bullock Diamond
Prospecting
Drills

General Features of Bullock Diamond Drills

A DIAMOND DRILL is made up essentially of three parts—the engines, the swivel head or feed works, and the hoisting apparatus.

The Engines are designed with a view of securing durability, economy, simple adjustments and quick repairs. No single design of engine has been made to do duty on the BULLOCK DRILLS, but each drill has been supplied with special engines of the one or two cylinder type, to be operated by steam or air, or both, as may be most suitable. In the smaller machines we have used the patent “trunk” piston, which permits of coupling the engines up close to the crank shaft and reducing the number and weight of reciprocating parts and attaining the highest rotative speed without undue vibration. On these engines our patent balanced slide valve is used, giving quick opening and large ports, so essential to compressed air motors. In the larger machines the engines are of the cross-heads-and-connecting-rod type, double-cylinder pattern, the center lines of the engines set at right angles.

In all of these power drills we use the horizontal crank shaft, fitted with bevel gear, which drives the drill spindle. All drills are provided with drain cocks for the steam pipes, steam chests and cylinders. After assembling, all engines are tested under load. All bearings are ample and arrangements for adjustments and lubrication are simple and effective. Ordinary repairs can be made by the drill operator, and it is seldom necessary to send a machine to the shops for repairs of any kind.

The Swivel Head is that portion of the drill which is attached to the front of the main frame and carries the hollow spindle and the feed works. On all of these drills we use our Patent Hinged Swivel Head, which permits of placing the drill rigidly upon its foundations when starting a hole and not moving it until the hole is completed, the swivel head being unlocked and swung back on its hinge out of the line of the hole when hoisting or lowering rods, inserting casing, driving pipe, etc. The swivel head is swung back into its correct position each time, in *exact* line with the hole, thus saving time in lining up and preventing the possibility of any undue strain on the rods or the machine by being out of alignment.

The Screw Feed. The hollow drill spindle is provided with a chuck or clamp for firmly holding the rods, and it is threaded on the

outside, thus serving the purpose of a feed screw. The feed-nut gear is located at the bottom of the swivel head and driven by a smaller gear carried on a short countershaft, upon the upper end of which are placed a number of feed gears, which in turn are driven by corresponding gears mounted on a sleeve surrounding the feed screw. This sleeve is driven by key and spline from the feed screw. The ratio of all these gears is such that the rotation of the feed nut is retarded, and the feed screw, driving the drill rods and the bit, is fed forward at a positive rate of advance ranging from 1-50 to 1-2400 of an inch to each revolution of the bit. The feed gears and countershaft are so constructed that the change from one rate of speed to another can be made while the drill is running, by shifting a single handle controlling the countershaft. This system of feed gives the widest range of adjustment necessary for drilling any known rocks. To illustrate: The rotative speed of a diamond bit is from 200 to 1500 revolutions per minute, according to the size of the bit, condition of the rock, its hardness, etc. With the bit running 400 revolutions per minute, the "50" feed—*i. e.*, the gear giving 50 revolutions to the bit for one inch advance—will give a cutting speed of eight inches per *minute*. With the "2400" feed, the bit running at 600 revolutions per minute, will have a cutting speed of fifteen inches per *hour*. These rates of feeds are extremes, seldom called for and never exceeded.

With this system of feeds the greatest accuracy is attained in determining the exact point at which changes occur in the formations. The bit being fed forward at a ratio constant to the revolutions of the bit, the load on the engines varies according to the hardness of the rock. In running from hard to soft rock the cutting capacity of the bit is increased comparatively and the load on the engines is diminished, with the result that they "speed up," and thus indicate that a change of formation has been encountered. With this positive information, the operator immediately adjusts his feed to a faster rate, by simply shifting a single lever. In running from a soft to a hard stratum, the engines running under a partially closed throttle will gradually slow down as the bit advances into the harder rock and frequently will stop unless the operator opens the throttle. It is obvious that a mere novice can tell from the running of the engines alone the exact points at which the changes occur in the strata, and by using a two-foot rule and "common sense" he can make an indisputable record or log of the borings.

Hoisting Apparatus.—In all diamond drilling operations the question of handling the rods into and out of the hole quickly is one of importance, and when a delay occurs it is doubly vexatious, as this very necessary operation is usually considered “deadwork.” It is therefore essential that each drill be properly equipped for expediting this portion of the work. We have kept this idea in mind in fitting each drill with hoisting apparatus specially suited to the particular requirements in each case.

For shallow boring with the hand-power drill, no hoist is necessary, a block-and-falls being used, but if the work is carried to a considerable depth, a small hand-power hoist is bolted to the back brace rods, the drum driven by gear and pinion from a pair of cranks.

All of these power drills are supplied with drums or gypsy-heads, as seem best adapted. On the underground drills the drums are of small diameter and driven from the engines with only one set of gears, enabling the operator to handle the short lines of rods very quickly. A friction brake band on the drum gives perfect control and permits of lowering the rods into the hole without running the engines. The surface drills are all supplied with heavy hoisting gear, so that large drive-pipe and casing can be handled without loss of time. The simplest gear is that used on the “BEAUTY,” with a set of back gears driving the large spur gear cast on the drum shell. These can be thrown out and the drum remains stationary when drilling is resumed.

Another type is the internal-gear drum, driven by spur gear and pinion from the engine shaft, power being thrown on when required by a friction driving band. With this type of drum we always fit it with a friction brake band, so that the load may be lowered or held stationary while the engines are running. Where there is a large amount of pipe-driving, this type of hoist is the most convenient, the drum responding quickly and positively to the operations of the friction bands.

Detailed descriptions of the hoisting apparatus used on each drill will be found in the following pages. As the engines and feed mechanism have been carefully planned to suit the work for which each drill has been designed, the hoists have received the same attentive study.

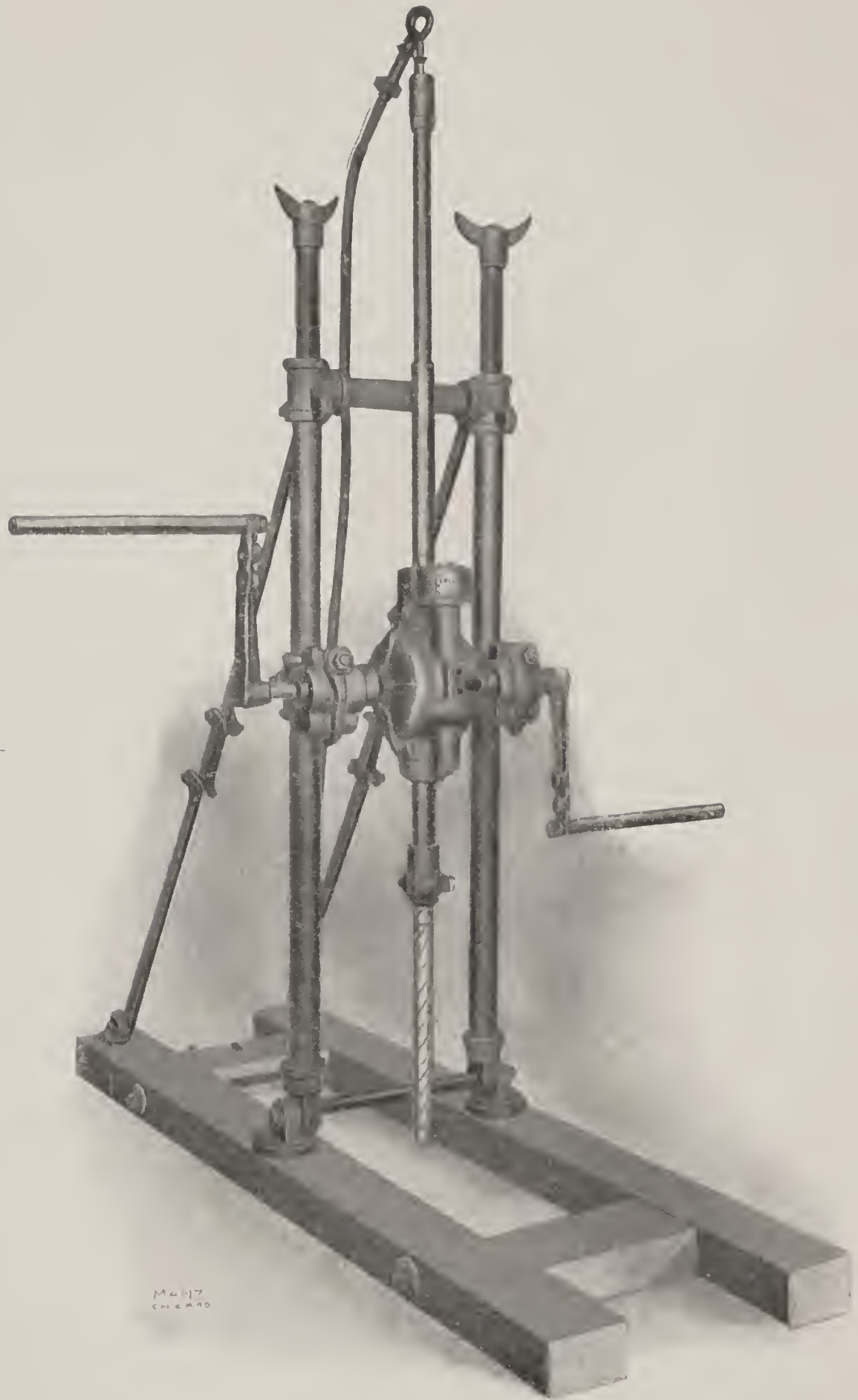


Fig. 50.

**Bullock Diamond Prospecting Core Drill
The "Bravo" (Hand Power)**

Capacity, 350 ft. depth.
Diameter of hole, $1\frac{3}{8}$ in.
Diameter of core, $1\frac{1}{8}$ in.

The "Bravo" (Hand Power)

In designing the "BRAVO" Drill we endeavored to produce a machine that would combine the qualities of portability, accuracy and durability—one that might be operated in localities inaccessible to our larger power drills and still give reliable records of the strata penetrated. That we accomplished this is shown by the many testimonials we have received, a few of which we publish.

The cut (Fig. 50) shows the regular manner of fitting up the "Bravo" Drill for hand-power operation. The main columns are attached by hinged feet to the wooden frame and steadied by back brace rods, which are adjustable to any position; the swivel head is secured to the columns by adjusting clamps, allowing the spindle to be turned in any direction, so that holes can be drilled at any angle, ranging from horizontal to perpendicular.

The timbers form a solid foundation, preventing any tendency of the columns to spread or slide. The drill spindle is hollow and fitted with a chuck at the lower end. This allows the use of long rods.

The thrust of the bit on the rock is taken by ball-bearings on the feed-nut, reducing friction and the amount of power required for operating. The differential screw feed is used and two sets of feed gears are mounted on the machine, either of which can be thrown into or out of gear instantly while the drill is running.

The total weight of the machine is about 325 pounds; the drill, off columns, weighs 120 pounds; but this can be divided into packages weighing less than 40 pounds, so that it can be transported easily in a rough country.

We furnish a small hand-power hoist, attached to the back brace rods, the drum being driven from the cranks by gear and pinion. This hoist costs \$35.00 extra.

When used underground, the back brace rods are removed and the extension screws in tops of columns are extended against blocking or the roof of the tunnel. No further change is necessary, as this makes a column mounting the same as those used with the power drill.

With the regular equipment the "BRAVO" bores a $1\frac{9}{16}$ inch hole, cutting a $\frac{15}{16}$ inch core. For work in coal formation we supply $1\frac{13}{16}$ inch boring tools, cutting a $1\frac{1}{8}$ inch core.

For equipment furnished with the "BRAVO" Drill and included in the price shown on page 121, see page 124.

For shipping weights and dimensions, see page 122.

Testimonials

A Hundred Feet Beyond Our Guarantee

GENTLEMEN: We have used the "Bravo" Drill purchased of you to bore a hole 500 feet deep, which is 100 feet deeper than you guaranteed the machine to work. Apparently the work was done as well, and with as little strain to the machine at 500 feet as at 200 feet. Our foreman assures me that so far as the strain on the machine is involved he would have no hesitancy in drilling to a depth of 600 feet. We are more than pleased with the "Bravo" Drill and can conscientiously recommend it to anyone desiring to prospect with a Diamond Drill.

Yours truly
VIRGINIA MINING & INVESTM'T CO.,
Staunton, Va.

Fifteen Feet a Day With the "Bravo"

GENTLEMEN: In reply to your letter of the 31st of January, would say: The "Bravo" Drill purchased from you proved entirely satisfactory. Our drilling was largely in very hard sandstone, the balance in shale. We bored to a depth of about 400 feet, averaging fifteen feet per day of ten hours.

Yours respectfully,

O. A. & W. T. THAYER (Sig.),
Charleston, W. Va.

"Bravo" Holds the Record for Boring by Hand Power

GENTLEMEN: I have had charge of one of your "Bravo" Hand Drills and have drilled with it to a depth of 628 feet in 45 days. I have had considerable experience with both hydraulic and friction feed drills, but must say that a better hand drill than the "Bravo" is not made. Our formation was mostly slate with some sandstone and basaltic rock. If the above is a record depth for the "Bravo" operated entirely by hand power, I should be pleased to be assured of the fact.

Yours truly,
W. W. CALVERT,
Dannhauser, Natal, South Africa.

Note: So far as we have been able to learn, this is a record depth for hand power prospecting. In a subsequent letter from Mr. Calvert, dated August 6, 1897, he states that he has drilled five holes as follows: 628 feet, 55 feet, 500 feet, 551 feet and 325 feet, aggregating 2,059 feet, in 147 working days, operating the machine by Kaffir boys exclusively.

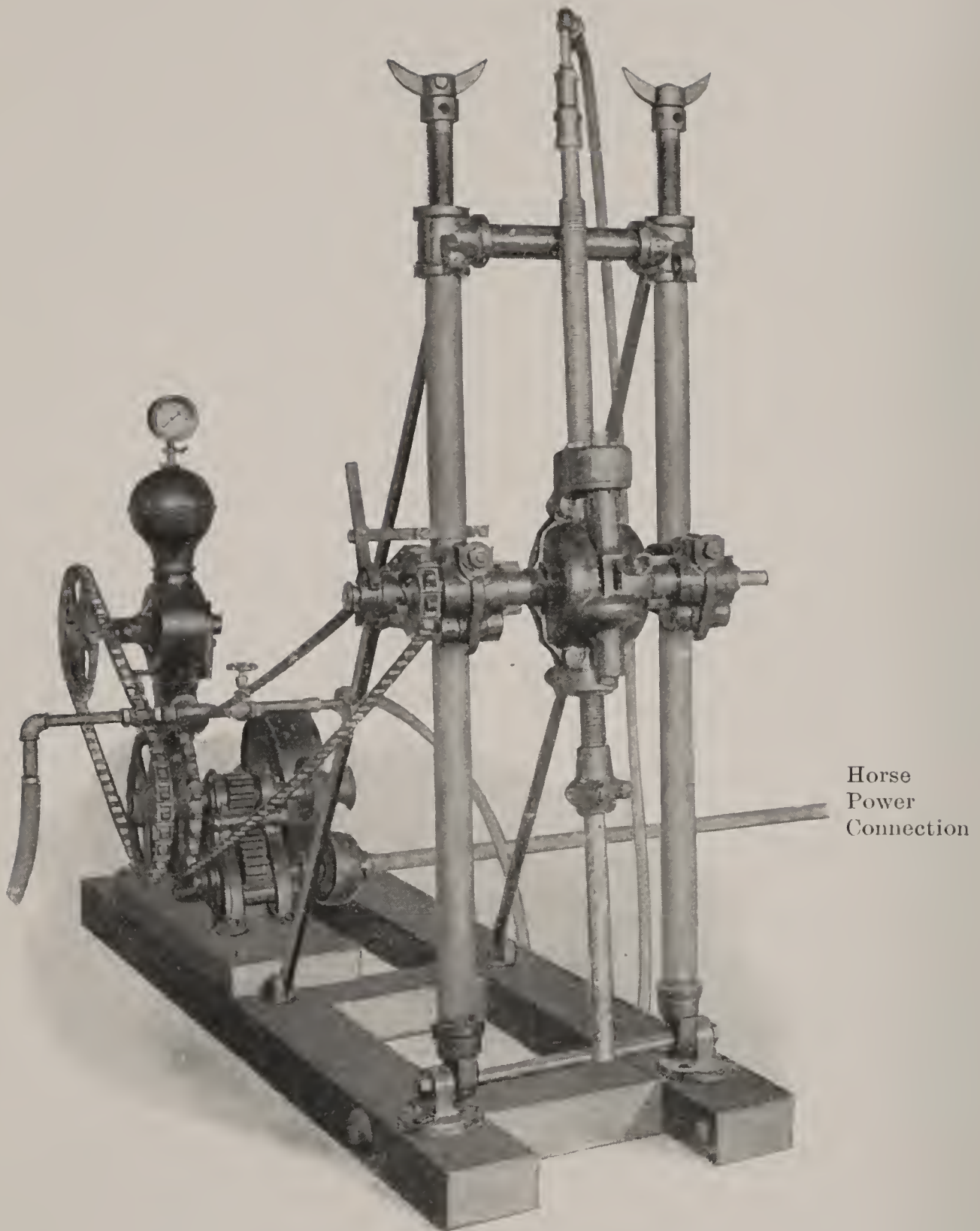


Fig. 51.

**Bullock Diamond Prospecting Core Drill
The "Bravo" (Horse Power)**

Capacity, 350 ft. depth.
Diameter of hole, $1\frac{3}{8}$ in.
Diameter of core, $1\frac{1}{8}$ in.

The "Bravo" (Horse Power)

The "BRAVO" can be transformed into a power drill by removing the cranks and substituting a horse-power attachment, Fig. 51. For the horse-power equipment we supply a geared power with tumbling rods and rests and with a jack fitted with a winch for hoisting the rods. We also furnish a belted power pump instead of the hand pump. (See page 124.) The same changes are made on the drill and pump when it is desired to take power from a small gas or steam engine or electric motor.

Price of Horse-Power Attachment Complete..... \$60.00
(See page 92)

"Bravo" Does Remarkable Work.

GENTLEMEN: Yours of the 26th ult. to hand. Am glad to report that the "Bravo" we are using is doing remarkable work. We are on our third hole now, having put down two holes to a depth of 150 feet each, making a total of 300 feet in twenty-five days of eight hours each, including moving and setting up machines, a distance of five miles. The bit you sent is holding out splendidly. I think that by ordinary care it will bore 1,000 feet before it is necessary to reset it. I will send you a short piece of core if you desire it, showing how hard the sandstones are. I take cores five feet long frequently. With thanks for your kind inquiry and hoping that you will use this record of the work I am doing with your "Bravo," and trusting you will call on me at any time if I can serve you in any capacity, I am,

Yours very truly,

A. T. WEST.

517 N. 21st St., Birmingham, Ala.

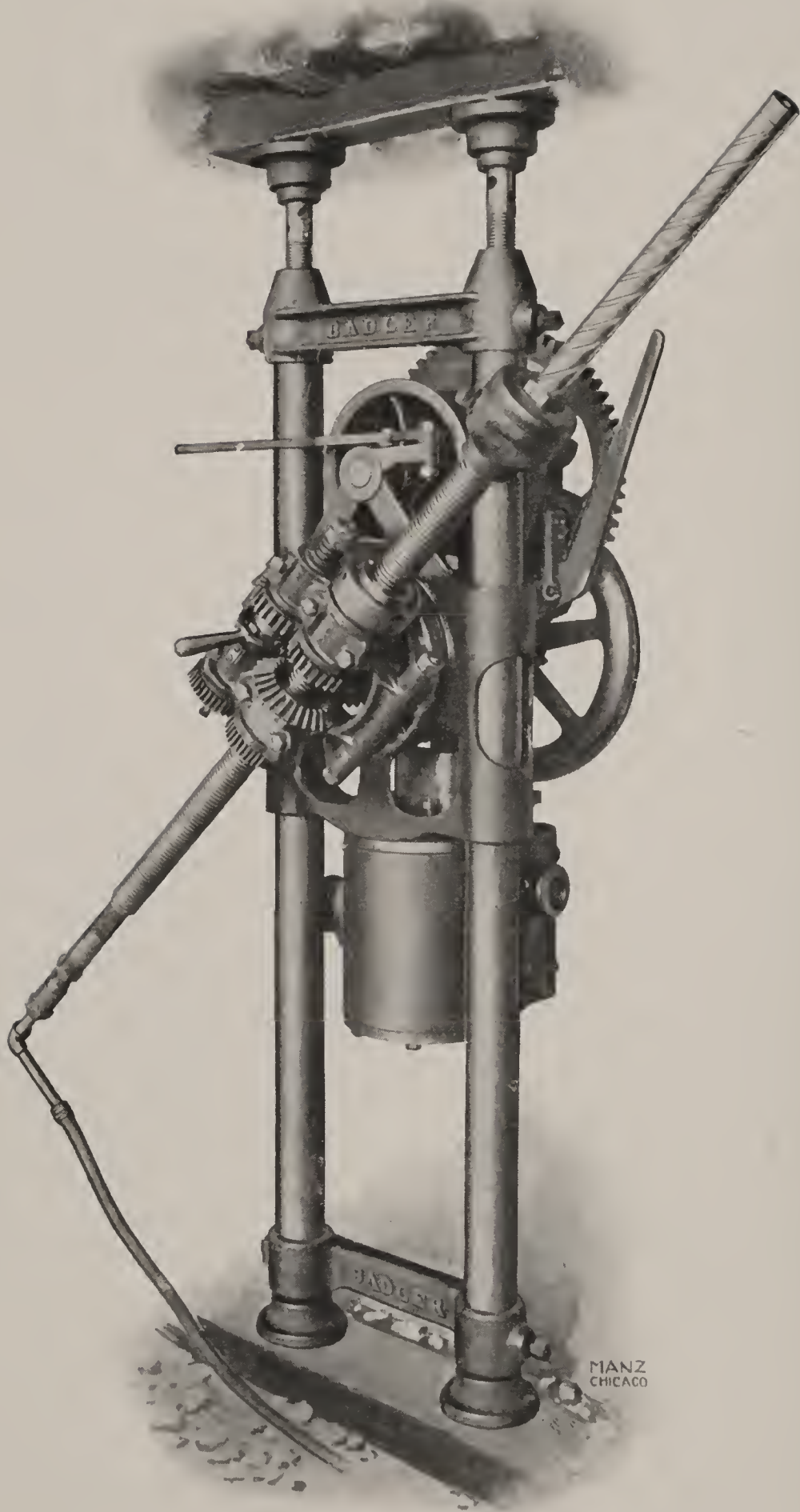


Fig. 52.

Bullock Diamond Prospecting Core Drill, The "Badger"

Capacity, 500 ft. depth.
Diameter of hole, $1\frac{9}{16}$ in.
Diameter of core, $\frac{1}{8}$ in.

The "Badger"

This machine was brought out to meet the demand for an underground prospecting drill—light and portable—that could be easily and quickly set up and dismantled, and moved from one location to another.

The engine is of the single cylinder "trunk" type, with balanced valve operated by steam or compressed air, and is attached to the lower end of the main frame just back of the columns; the drum is mounted at the top, fitted with a band brake, and can be thrown out of gear when not in use. The hinged swivel head is mounted in the center of the main frame and just in front of the columns, bringing the chuck close to the rock wall; it can be adjusted to bore holes at any angle. Feed gears to give any desired cutting speed can be used, and a friction device prevents the forcing or breaking of diamonds. The columns are adjustable to suit the height of the workings.

The drill, as shown in cut, weighs less than six hundred pounds, and can be divided into fifty-pound packages.

For equipment furnished with the "BADGER" Drills, and included in price shown on page 121, see page 123.

For shipping weights and dimensions, see page 122.

Testimonials

"Badger" Is Economical in Quincy Granite

Commonwealth of Massachusetts.

GENTLEMEN: In answer to your letter of June 22d, will say that we obtained the "Badger" drill from you in November, 1895, and have had it continually in use ever since, working through the hardest kind of syenite rock, and also in the softer schist rocks. We have used bits varying from $1\frac{3}{8}$ inches to 1.9 inches.

At present we are putting down a hole which has reached a depth of 250 feet, and will be continued to 300 feet, with a bit $1\frac{3}{4}$ inches in diameter, giving us a core 13-16 inches, and the machine is amply able to handle this depth of hole. The machine has worked satisfactorily in every respect, and we have not been to scarcely any expense in the way of repairs. I consider it a very complete drill for one of its size, and gladly indorse it.

Yours very truly,

T. F. RICHARDSON,

Department Engineer, Metropolitan Water Board, Clinton, Mass.

The "Badger" in Northern Minnesota

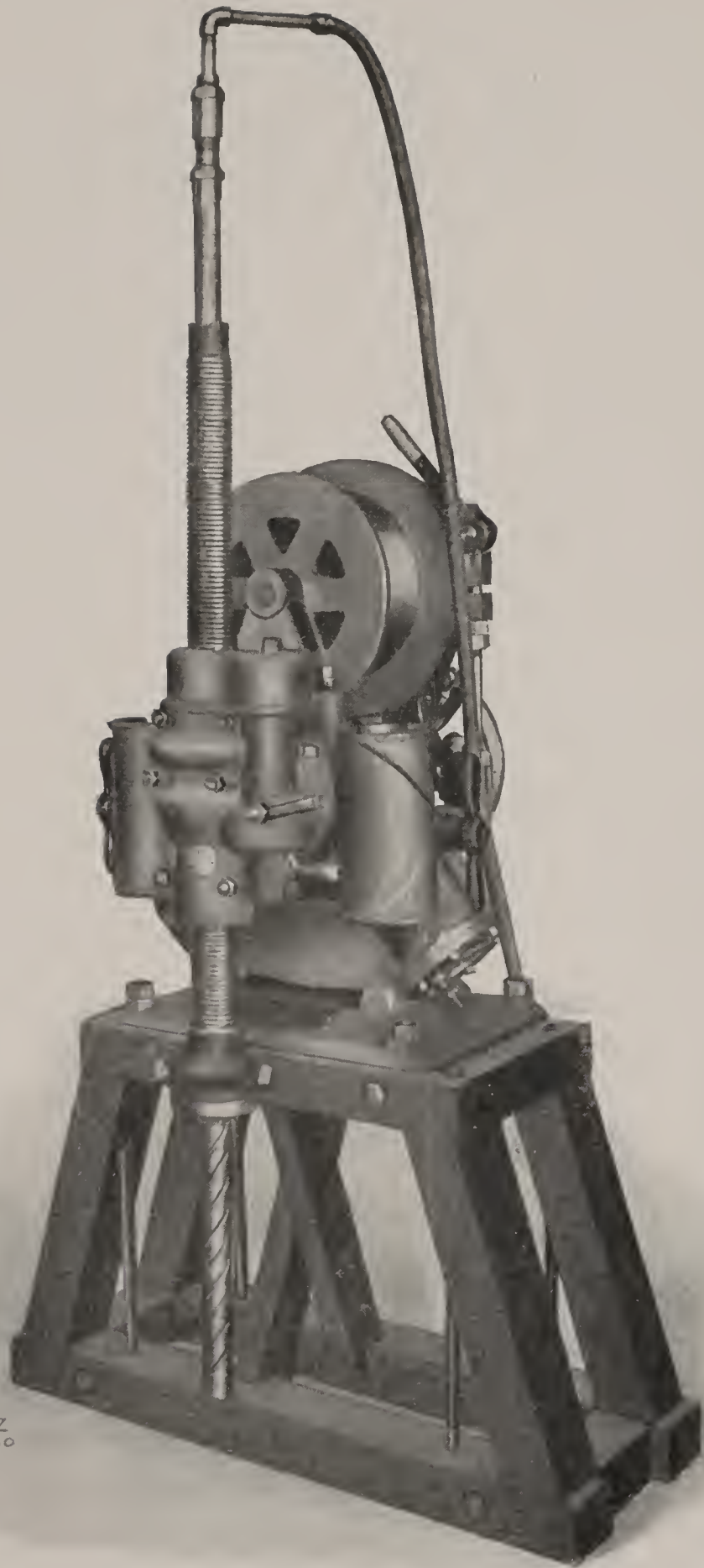
GENTLEMEN: The Badger Diamond Drill we bought from you two months ago gives entire satisfaction as an efficient, rapid and economical prospecting engine, and our Company is well pleased with it.

Yours respectfully,

JOHNSON NICKEL MINING CO.,

OTTO MONSON, Sec'y,

St. Paul, Minn.



MANZ
CHICAGO

Fig. 53.

**Bullock Diamond Prospecting Core Drill
The "Beauty"**

Capacity, 800 ft. depth.
Diameter of hole, $1\frac{9}{16}$ in.
Diameter of core, $\frac{1}{16}$ in.

The "Beauty"

The illustration, Fig. 53, shows clearly the general design of the "BEAUTY" drill with its surface mounting. It has two cylinders, "trunk" type, with large ported valves, adapting it for operation either by steam or compressed air. The cylinders are set at right angles, and the revolving parts are so evenly balanced that the drill can be run at a very high speed without vibration. The main shaft, eccentrics and crank pin are forged solid, the connecting rods fitted with steel bushings, and provision made for oiling all working parts thoroughly, thus insuring durability. As proof of this, there are "BEAUTY" drills running now which have been in use for more than sixteen years.

The "BEAUTY" on bed plate occupies a space only twenty inches square, and weighs, complete, less than five hundred pounds. From this data, its utility as a surface prospector might be doubted, but it has been used successfully in boring hundreds of holes in the hardest and most broken ground; in this country it has been used extensively in the Lake Superior region, Montana, Colorado and Arizona, prospecting for iron, copper, gold and tin; in Austria for copper prospecting; in the Caucasus Mountains and South Africa for gold, and in Chili, Bolivia and Mexico for gold, silver and lead. The "BEAUTY" is fitted with a hoisting drum operated by gear and pinion from the main shaft and controlled by a band brake.

We guarantee the "BEAUTY" for boring a one and nine-sixteenths inch hole to a depth of eight hundred feet, or a one and three-quarters inch hole to a depth of six hundred feet.

For equipment furnished with the "BEAUTY" Drill and included in the price shown on page 121, see page 123.

For shipping weights and dimensions, see page 122.

Testimonials

Twenty-three Feet in 8 Hours in Porphyry

GENTLEMEN: The "Beauty" Drill is running beautifully. We made 23 feet in an eight-hour shift on Wednesday of this week. This was in porphyry, close-grained, hard rock. We are much pleased with it.

Very truly yours,

THE DOCTOR MINE,

By JAMES J. CONE,

Anaconda, Colo.

The "Beauty" a Good All-Around Machine

GENTLEMEN: I am doing good work with the "Beauty" Drill and find it the best machine for all-around work in rough places. I have bored with it 3,100 feet, and it is in good repair yet.

Yours truly,

THOS. E. SMITH,

Superintendent Rat Portage Diamond Drill Company, Rat Portage, Ont.

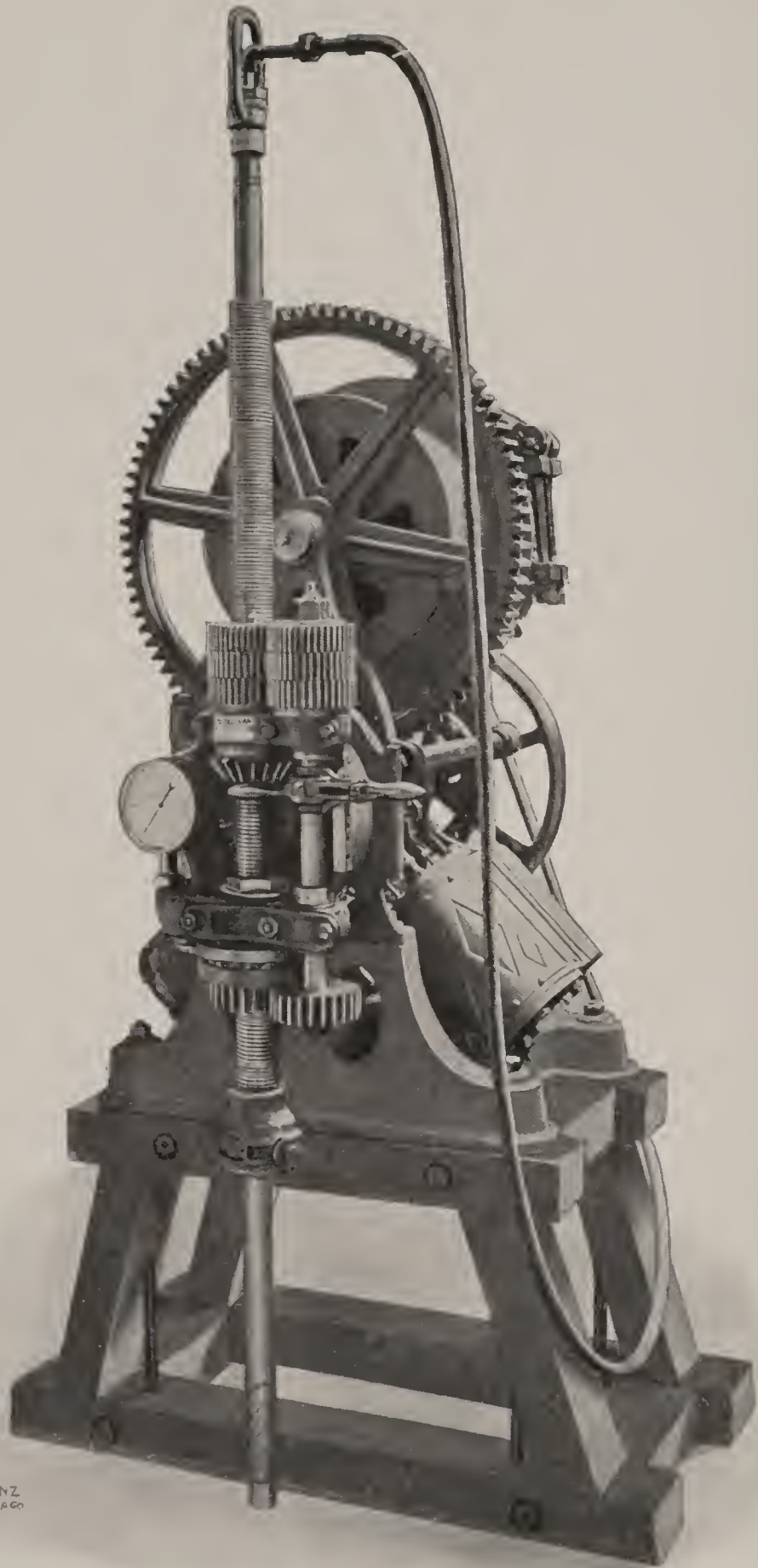


Fig. 54.

**Bullock Diamond Prospecting Core Drill
The "Champion," Screw Feed**

Capacity, 1,500 ft. depth.
Diameter of hole, $1\frac{3}{8}$ in.
Diameter of core, $1\frac{1}{3}$ in.

The "Champion"

This is a modification of one of our pioneer machines, the "LITTLE CHAMPION," which was used so extensively in the development of the resources of the Lake Superior iron and copper country. It has been twice redesigned, the main features of the original machine being retained, but such changes made in the engines, gearing and hoist as have been suggested from actual operation as being improvements.

The engines are our standard "trunk" type, double-cylinder, coupled at right angles to a forged crank shaft, and so neatly balanced that a very high speed can be developed without vibration or undue strain in any part. The engines are fitted with balanced valves, operated by a reversible eccentric, and are designed for operation either by steam or compressed air.

The hoisting drum is of the compound internal-gear pattern, and so proportioned that long lines of rods or casing can be handled with a single sheave. Power is applied to the drum by a friction driving band, fibre lined, and the drum brake is of the continuous band type, also fibre lined. Both the driving and the brake bands are operated by hand levers and cams, placed in a convenient position. The drum runs loose on the shaft so that rods can be lowered under control of the brake, without running the engines.

The machine can be easily dismantled for transportation on mule-back, or moving from point to point inside a mine. The total weight of the "CHAMPION" Drill is about 1,250 pounds.

For equipment furnished with the "CHAMPION" Drill, and included in the price shown on page 121, see page 123.

For shipping weights and dimensions, see page 122.

Testimonials

Remarkably Rapid Work With the Champion

GENTLEMEN: Replying to your inquiry as to the amount of drilling done here with the Diamond Drill of your make, I have, up to date, completed, with one machine, the "Champion," 30,766 feet. The character of the rock is hard gneiss. With two men besides myself I drilled 5,000 feet in one month, 500 feet in one week, six days' run, single shift, 227 feet and 618 feet in 23 days' time.

I have just started the "Champion" Drill on some deep drilling, of which I will give you the record later.

Yours truly,

CHAS. GARVEY,
Hammondville, N. Y.

Working 27 Months, Double Shift; Repairs Less Than \$50.00

DEAR SIR: Yours of October 22d in relation to our opinion as to the merits of your Diamond Drill was duly received. It is a gratification to me to assure you that after a long-continued and successful use of two of your "Little Champion" Drills, I cannot too highly commend them, not only for workmanship, but for effectiveness and economy in explorations for iron ore. I worked "Little Champion" Drill No. 21 constantly, day and night, for twenty-seven months, and the expense for repairs during that period was less than fifty dollars. We owe the discovery of this (Ludington) mine solely to the work of this drill, and regard it as the father of the mine.

Yours truly,

G. E. STOCKBRIDGE,
Manager Lumbermen's Mining Co., Iron Mountain, Mich.

Six Months With a Diamond Drill Equal to Two Years Drifting

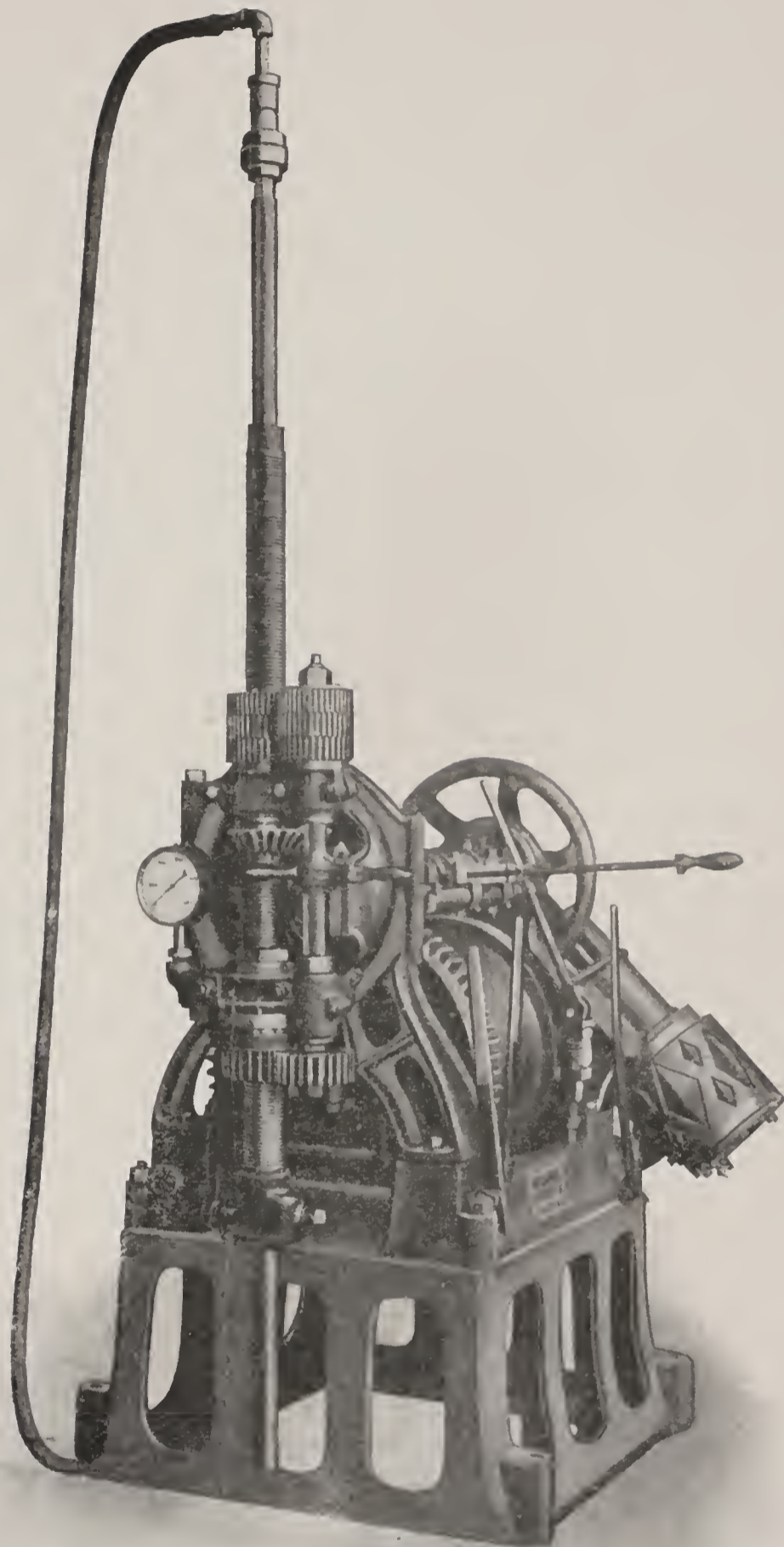
GENTLEMEN: We have been using your "Little Champion" Diamond Drilling Machine for exploring purposes at this mine on Mount Bross for the past six months. In its use we have encountered and overcome a great many difficulties incident to the position of the mine, which is at an altitude of 13,600 feet above the ocean, and about 2,600 feet above the timber line. The machine has already given as much information as to the vein phenomenal of the deposits as could be accomplished by two years' drifting in the same ground. No company should attempt to work the class of deposits that occur in this portion of Colorado without one of these machines.

In lightness, ease of portability, and finished construction, I give decided preference to your machine over any other.

Respectfully yours,
JACOB HOUGHTON,
Superintendent Moose Mining Company, Dudley, Colo.

Fast Work With the "Champion"; Deep Holes with the "Detector"

GENTLEMEN: In reply to your letter will say that with the "Champion" Drill we completed a contract 2,750 feet in four months. The ground is a hard, badly broken gumice. We have put down three holes, one 1,196 feet, one 1,105 feet, another 1,890 feet in depth, with the "Detector" Drill. This last we believe to be the greatest depth reached in Northern New York.



MANZ
CHICAGO

Fig 55.

**Bullock Diamond Prospecting Core Drill
The "Detector"**

Capacity, 2,500 ft. depth.
Diameter of hole, $2\frac{1}{16}$ in.
Diameter of core, $1\frac{3}{8}$ in.

The "Detector"

With a capacity for boring $2\frac{1}{16}$ -inch hole two thousand five hundred feet deep, the "DETECTOR" replaces the "DELVER;" in design it combines all the new features of the later style of construction. Every detail of design has been carefully considered, and no pains spared in its construction.

The engines are of the cross-head-and-connecting-rod pattern, with balanced valves actuated by a drag-crank eccentric, with our special cut-off adjustment. The main frame is very heavy; the large spur gear operating the hoisting drum is made of semi-steel and other gears from cast steel. The drum is of large diameter to wind heavy rope, and fitted with a friction brake-band controlled by a hand lever. By using a system of back-gears, four different hoisting speeds can be used, as best adapted for handling the load; in deep-hole work this is very convenient, as a long line of rods can be hoisted without the bother of running-sheaves or counterbalances.

The "DETECTOR" is supplied with our hinged swivel head fitted with positive screw feed.

Boring tools, drilling a $2\frac{1}{16}$ -inch hole, cutting a one and three-eighths inch core, are regularly furnished with the "DETECTOR," but it can be equipped readily with other sizes of tools boring larger holes and extracting larger cores. When the larger sizes of boring tools are used, the capacity as regards depth is of course diminished to a certain extent. Full information on this point will be furnished upon request.

For equipment furnished with the "DETECTOR" Drill, and included in price shown on page 121, see page 123.

For prices and other data, see page 122.

Testimonial

The "Delver"* Proves Its Versatility

*The "Detector" replaces the "Delver."

GENTLEMEN: In reply to your letter about the work of the "Delver"* Drill you furnished this company, I beg to state that up to date we have drilled 50 holes, ranging in depth up to 932 feet 4 inches, aggregating 13,741 feet. This work was done in 1,268 days, including all time required for moving the machinery from one point to another, setting up and dismantling. Holes were bored at all angles between the horizontal and the perpendicular, and in all variations of material found in this section. If you find anybody who wants to learn about the workings of your drill, we will be pleased to communicate with them either personally or by letter.

Yours truly,

COMMONWEALTH IRON, CO,
Commonwealth, Wis.

**Table of Sizes, Capacities, Dimensions and Other Data of the
Bullock Diamond Prospecting Core Drills**

Size of Drill	Capacity		Diam. of Core, Inches	Steam Pipe, Inches	Exhaust Pipe, Inches	Pump Required	H. P. Boiler Required for Drill and Pump	Space Required, Drive Rod in Lowest Position		Price with Equipment, Per Pages 123 and 124	Code Word
	Depth of Hole, Feet	Diam. of Hole, Inches						Floor Space	Height		
Bravo (Hand Power).	350	1 13/16	1 1/8	Hand Power						\$ 400.00	Brahman
Bravo (Horse Power).	400	1 13/16	1 1/8	Horse Power						460.00	Brawl
Badger.....	500	1 9/16	1 5/8	1 1/2	2	3 x2 x3	6			900.00	Baddish
Beauty.....	800	1 9/16	1 5/8	1 1/4	1 1/2	3 x2 x3	8	2' x 3' 4"	4' 5"	1,500.00	Beauteous
Champion.....	1500	1 13/16	1 1/8	1 1/2	2	4 1/2 x2 3/4 x4	10	3' x 3' 7"	6' 4"	2,700.00	Chamade
Detector.....	2500	2 1/16	1 3/8	1 1/2	2 1/2	6 x4 x6	15	4' x 4' 6"	5' 1"	3,500.00	Detective

See descriptions, pages 108 to 120.

*The sizes of holes and cores can be increased by equipping any of the above machines with special outfits of larger boring tools.

Above prices are net, f. o. b. Chicago, Ill.

See pages 123 and 124 for lists of "Regular Equipments," included in prices quoted. For extra equipment and estimates on complete general outfits, see pages 124 to 128.

Ocean Shipping Weights and Dimensions of Bullock Diamond Drills, Fitted with Regular Equipment

Bravo Drill

Weight of Drill and Equipment, lbs. (page 124).....	1,100
Number boxes for shipping.....	4
Occupying about, cubic feet.....	27

Bravo Drill

(With Horse Power Attachment.)

Weight of Drill and Equipment, lbs. (page 124).....	2,000
Number boxes for shipping.....	7
Occupying about, cubic feet.....	45

Badger Drill

Weight of Drill and Equipment, lbs. (page 123).....	2,100
Number boxes for shipping.....	5
Occupying about, cubic feet.....	33

Beauty Drill

Weight of Drill and Equipment, lbs. (page 123).....	1,800
Number boxes for shipping.....	5
Occupying about, cubic feet.....	34

Champion Drill

Weight of Drill and Equipment, lbs. (page 123).....	2,900
Number boxes for shipping.....	8
Occupying about, cubic feet.....	89

Detector Drill

Weight of Drill and Equipment, lbs. (page 123).....	5,500
Number boxes for shipping.....	7
Occupying about, cubic feet.....	182

Equipment Tables

The following "regular equipment" is furnished with the "BEAUTY," "CHAMPION" and "DETECTOR" Drills, and is included in prices shown on page 121.

- | | |
|--|--|
| <ul style="list-style-type: none"> 2 Blank Bits, ready to set. 205 feet of Drill Rods with Couplings (20 10-foot, 1 5-foot). 1 20-inch Core Barrel (only necessary with the "Beauty" Drill). 1 10-foot plain Core Barrel. 1 Core Shell and 2 Core Lifters. 20 feet four-ply Water-hose, with connection, to connect drill and pump. 1 Wire Rope (wound on Hoisting Drum) with Hook. With "Champion" and "Beauty," 75 feet of 1/2-in. Rope; with "Detector," 100 feet of 5/8-in. Rope. 1 Safety Clamp. 1 Sheave for Hoisting Rods, with Strap and Hook. 1 Lifting Bail with Clevis. 1 Bail and Bolt for Sheave. 1 Lifting Swivel or Hoisting Plug, with Coupling. 1 Water Swivel, with Coupling and Elbow. 1 Tool Chest, with Lock and Key. 1 pound No. 18 Copper Wire. 1 Machinist's Hammer. | <ul style="list-style-type: none"> 1 Complete set of Diamond-setting Tools, consisting of— 1 3 1/4-in. Jaw Vise, with swiveled base. 1 Breast Drill, with 5 Bits from 1/8-in. to 1/4-in. diameter. 1 Set of 12 Setting Chisels and Punches. 1 Light Hammer for diamond setting. 1 Pair each, 6-inch Dividers, Inside and Outside Calipers. 1 Head for holding Bits while setting. 1 6-inch Adjustable Level. 2 Pairs Pipe Tongs, adjustable 1 to 2 inches. 1 14-inch Pipe-wrench. 2 12-inch Monkey-wrenches. 1 Complete set of solid Wrenches for Engine, Chuck, etc. 1 Hand Oiler. 1 1-gallon Oil Can. 1 Engine Oil Cup, with Valve. 2 Recovering Taps. Rubber and Hemp Packing and Waste. All Pipe and Fittings necessary to connect Drill, Pump and Boiler. |
|--|--|

The following equipment is furnished with the "BADGER" Drill, and is included in prices shown on page 121.

- | | |
|---|--|
| <ul style="list-style-type: none"> 2 Blank Bits ready to set. 200 Feet of Drill Rods, with Couplings (39 5-foot, 5 1-foot). 1 20-inch Core Barrel. 1 5-foot Plain Core Barrel. 1 Core Shell and 2 Core Lifters. 20 Feet of 1/2-in. 3-ply Water-hose. 1 Water Swivel, with Coupling. 1 Lifting Swivel, with Coupling. 1 Safety Clamp. 1 Extra set of Feed Gears. 1 Tool Chest, with Lock and Key. 1 Complete set of Diamond-setting Tools, consisting of— 1 3 1/4-in. Jaw Vise, with swiveled base. 1 Breast Drill, with 5 Bits from 1/8-in. to 1/4-in. diameter. 1 Set of 12 Setting Chisels and Punches. 1 Light Hammer for diamond setting. | <ul style="list-style-type: none"> 1 Pair each, 6-inch Dividers, Inside and Outside Calipers. 1 Head for holding bits. 1 Machinist's Hammer. 1 6-in. Adjustable Level. 1 Pair Pipe Tongs. 2 14-in. Pipe-wrenches. 2 10-in. Monkey-wrenches. 1 Complete set of solid Wrenches for Engine, etc. 1 13-in. Sheave Wheel, with Strap and Hook. 1 Hand Oiler. 1 Half-gallon Oil Can. 1 Engine Oil Cup. 2 Recovering Taps. Rubber and Hemp Packing and Waste. Valves and Fittings ready to connect to supply of steam or compressed air. |
|---|--|

The following equipment is furnished with the "BRAVO" Drill, and is included in prices shown on page 121.

2 Blank Bits ready to set.	1 Water Swivel.
1 Set of 12 Chisels and Punches for diamond setting.	1 Lifting Swivel.
1 Head for holding bits while setting.	1 Safety Clamp.
100 Feet of Drill Rods with Couplings (9 10-ft., 1 5-ft., 3 20-in.).	1 Complete set of Feed Gears (3 pairs).
1 Lever Hand Pump.	1 Tool Box, with Lock and Key.
1 10-ft. plain Core Barrel.	2 Pairs Pipe-tongs.
1 20-in. Core Barrel.	1 14-in. Pipe-wrench.
1 Core Shell and Lifter.	1 10-in. Monkey-wrench.
12 Feet of 1-in. 4-ply Suction-hose, with connection and strainer.	1 Complete set of solid Wrenches.
10 Feet of 1/2-in. 2-ply Water-hose.	1 Hand Oil Can.
	1 Half-gallon Oil Can.
	1 13-in. Sheave Wheel, with Strap and Hook.

"Bravo" Drill Estimate (for Prospecting from Surface or Underground)

1. "Bravo" (screw feed) Drill and Equipment, as per pages 121 and 124.....	\$400.00
2. 1 Hand Hoist (used with hand power only).....	35.00
3. 200 Feet Extra Drill Rods (5-ft. sections), making 300 feet with those in Equipment, at \$75.00.....	150.00
4. 12 Extra Blank Bits, size "E," at \$1.00.....	12.00
5. 4 Extra Core Lifters, size "E," at \$2.50.....	10.00
6. 2 Extra Core Shells, size "E," at \$5.00.....	10.00
7. 1 Set Carbon, 6 Stones; weight 6 karats, @ \$50.00. (Price of carbon subject to change without notice; see page 87)	300.00
8. 1 Cross Chopping Bit, size "E".....	5.00
9. Setting Carbon in one of the above Blank Bits.....	6.00
10. 24 Feet Casing Pipe, size "E," style Flush Coupling, 5-ft. lengths, at .75.....	18.00
11. 5 Pair Protectors for E Casing, at .50.....	2.50
12. 1 Casing Bit, size "E".....	2.50
13. 1 Bushing, "E" Rods to "E" Casing.....	3.00
Total price, F. O. B. Chicago.....	\$954.00
Packing and Boxing for Ocean Shipment, extra.....	10.00

Total weight of Drill and outfit as above, about 2,500 pounds, boxed for foreign shipment.

Code Word for ordering "Bravo" Drill, with above (hand-power) outfit complete, *Xabinada*.

Code Word for ordering "Bravo" Drill with above outfit complete, Drill Rods and Casing in 10 ft. lengths, *Xabina*.

NOTE—If desired to operate the above machine by horse power, add the following:

14. 1 Horse Power, with Jack, Belt and Drill Pulley.....	\$ 60.00
15. 1 15-in. Pulley for attaching power to crank shaft.....	4.50
Total price, F. O. B. Chicago.....	1,028.50
Packing and Boxing for Ocean Shipment, extra.....	5.00

One power pump is furnished with the Horse Power outfit and is included in price shown on page 121.

Total weight of Drill and outfit as above, about 3,500 pounds, boxed for foreign shipment.

Code Word for ordering "Bravo" Drill, with horse power outfit as above, complete, *Xabinoam*.

“Badger” Drill Estimate (Equipped for Underground Prospecting)

1.	“Badger” Drill (screw feed) and Equipment as per pages 121 and 123.....	\$ 900.00
2.	1 Special Duplex Steam Pump, size 4½ x 2¾ x 4.....	80.00
3.	16 Feet 1¼-inch Suction Hose, with Strainer.....	8.50
4.	100 Feet extra Drill Rods (5-ft. sections), making 300 feet with those in Equipment, at \$75.00.....	75.00
5.	24 Extra Blank Bits, size “E,” at \$1.00.....	24.00
6.	6 Extra Core Lifters, size “E,” at \$2.50.....	15.00
7.	4 Extra Core Shells, size “E,” at \$5.00.....	20.00
8.	1 Set Carbon, 6 Stones; weight 9 karats, at \$50.00. (Price of Carbon subject to change without notice; see page 87).....	450.00
9.	1 Cross Chopping Bit, size “E”.....	5.00
10.	Setting Carbon in one of the above Blank Bits.....	6.00
11.	50 Feet Casing Pipe, size “E,” style Flush Coupling, 5-ft. lengths, at .75.....	37.50
12.	10 Pair Protectors for size “E” Casing.....	5.00
13.	1 Pair Casing Pipe Clamps, size “E”.....	4.00
14.	1 Bushing, “E” Rods to size “E” Casing.....	3.00
15.	1 Improved Long Reamer, size “E”.....	22.00
16.	1 Extra Reamer Face, size “E”.....	2.50
		\$1,657.50
Total price, F. O. B. Chicago.....		\$1,657.50
Packing and Boxing for Ocean Shipment, extra....		15.00

Total weight of Drill and outfit as above, about 3,500 pounds, boxed for foreign shipment.

Code Word for ordering “Badger” Drill with above outfit complete, *Xabilities*.

“Beauty” Drill Estimate (Equipped for Prospecting from Surface)

1.	“Beauty” (screw feed) Drill and Equipment, as per pages 121 and 123.....	\$1,500.00
2.	8 H. P. Boiler, mounted on wheels, with injector and complete fittings.....	400.00
3.	1 Special Duplex Steam Pump, size 4½ x 2¾ x 4.....	80.00
4.	16 Feet 1¼-in. Suction Hose, with Strainer.....	8.50
5.	200 Feet Extra Drill Rods (10-ft. sections), making 400 feet with those in Equipment, at \$65.00.....	130.00
6.	24 Extra Blank Bits, size “E,” at \$1.00.....	24.00
7.	6 Extra Core Lifters, size “E,” at \$2.50.....	15.00
8.	4 Extra Core Shells, size “E,” at \$5.00.....	20.00
9.	1 Set Carbon, 6 Stones; weight 9 karats, at \$50.00. (Price of Carbon subject to change without notice; see page 87)	450.00
10.	1 Cross Chopping Bit, size “E”.....	5.00
11.	Setting Carbon in one of the above Blank Bits.....	6.00
12.	50 Feet Drive Pipe (or Stand Pipe), size 2½ in., at 50c....	25.00
13.	1 Steel Drive Head, size 2½ in.....	6.00
14.	1 Steel Drive Shoe, size 2½ in.....	6.00
15.	1 Drive Pipe Chopping Bit, size 2½ in.....	5.75
16.	1 Pair Drive Pipe Clamps, size 2½ in.....	4.50
17.	1 Cast Iron Drive Block.....	10.00
18.	100 Feet Casing Pipe, size “E,” style Flush Coupling, 10-ft. lengths, at .65.....	65.00
19.	10 Pair Protectors for “E” Casing, at .50.....	5.00
20.	1 Pair Casing Pipe Clamps, size “E”.....	4.00
21.	1 Bushing, “E” Rods to “E” Casing.....	3.00
22.	1 Improved Long Reamer, size “E”.....	22.00
23.	1 Extra Reamer Face, size “E”.....	2.50
24.	1 Pipe Cutter, cutting pipe to 2-in. diameter.....	2.25
25.	1 Set Pipe Stocks and Dies, threading pipe ½-in to 2-in. diameter	14.00
26.	2 Pair No. 13 Chain Tongs.....	12.00
27.	2 Jack Screws	14.00
28.	1 Each 6-in. Single and Double Block, with 100 feet of ¾-in. Manila Rope.....	6.00
29.	15 Feet of ⅜-in. Chain, with Hook and Ring.....	4.00
30.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
31.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels	6.00
32.	1 Sledge, Pick, Auger and Ax, with Handles.....	3.50
33.	1 Extra lot of Small Pipe, Valves and Fittings; extra Packing and Waste.....	25.00
	Total price, F. O. B. Chicago.....	\$2,890.25
	Packing and Boxing for Ocean Shipment, extra.	30.00

Total weight of Drill and outfit as above, about 10,000 pounds, boxed for foreign shipment.

Code Word for ordering “Beauty” Drill, with above outfit complete, *Xabismand*.

Code Word for ordering “Beauty” Drill, with above outfit, less Boiler and Pump, *Xabismar*.

“Champion” Drill Estimate (Equipped for Prospecting from Surface)

1.	“Champion” Drill (screw feed) and Equipment, as per pages 121 and 123.....	\$2,700.00
2.	12 H. P. Boiler, mounted on wheels, with injector and complete fittings.....	460.00
3.	1 Special Duplex Steam Pump, size 6 x 4 x 6 in.....	125.00
4.	16 Feet 2-in. Suction Hose, with Strainer.....	12.50
5.	800 Feet extra Drill Rods (10-ft. sections), making 1,000 feet with those in Equipment, at \$80.00.....	640.00
6.	24 Extra Blank Bits, size “A,” at \$1.25.....	30.00
7.	6 Extra Core Lifters, size “A,” at \$3.15.....	18.90
8.	4 Extra Core Shells, size “A,” at \$5.00.....	20.00
9.	1 Set Carbon, 8 Stones; weight 12 karats, at \$50.00. (Price of Carbon subject to change without notice; see page 87).....	600.00
10.	1 Cross Chopping Bit, size “A”.....	6.25
11.	Setting Carbon in one of the Blank Bits.....	8.00
12.	100 Feet Drive Pipe (or Stand Pipe), size 3 in. @ 75c.....	75.00
13.	1 Steel Drive Head, size 3 in.....	7.00
14.	1 Steel Drive Shoe, size 3 in.....	7.00
15.	1 Drive Pipe Chopping Bit, size 3 in.....	5.75
16.	1 Pair Drive Pipe Clamps, size 3 in.....	6.00
17.	1 Cast Iron Drive Block.....	17.00
18.	200 Feet Casing Pipe, size 2 in., style Flush Coupling, 10-ft. lengths, at 50c.....	100.00
19.	20 Pair Protectors for 2-in. Casing, at .50.....	10.00
20.	1 Pair Casing Pipe Clamps, size 2 in.....	4.00
21.	1 Bushing, “A” Rods to size 2-in. Casing.....	3.00
22.	1 Improved Long Reamer, size 2 in.....	22.00
23.	1 Extra Reamer Face, size 2 in.....	2.50
24.	1 Pipe Cutter, cutting Pipe to 2-in. diameter.....	2.25
25.	1 Set Pipe Stocks and Dies, threading Pipe ½-in to 2-in. diameter.....	14.00
26.	2 Pair No. 13 Chain Tongs.....	12.00
27.	2 Jack Screws.....	14.00
28.	1 Each 6-in. Single and Double Block, with 100 ft. of ¾-in. Manila Rope.....	6.00
29.	15 Feet of ⅜-in. Chain, with Hook and Ring.....	4.00
30.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
31.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels.....	6.00
32.	1 Sledge, Pick, Auger and Ax, with Handles.....	3.50
33.	1 Extra lot of Small Pipe, Valves and Fittings; extra Packing and Waste.....	25.00
	Total price, F. O. B. Chicago.....	\$4,972.90
	Packing and Boxing for Ocean Shipment, extra.....	60.00

Total weight of Drill and outfit as above, about 17,000 pounds, boxed for foreign shipment.

Code Word for ordering “Champion” Drill, with above outfit complete, *Xabdelas*.

Code Word for ordering “Champion” Drill, with above outfit complete, less Boiler and Pump, *Xabdelari*.

“Detector” Drill Estimate (for Prospecting from Surface)

1.	“Detector” Drill (screw feed) and Equipment, as per pages 121 and 123.....	\$3,500.00
2.	15 H. P. Boiler, mounted on wheels, with injector and complete fittings	\$485.00
3.	1 Special “Duplex” Steam Pump, size 6 x 4 x 6 in.....	125.00
4.	16 Feet 2-inch Suction Hose, with Strainer.....	12.50
5.	1800 Feet extra Drill Rods (10-ft. sections), making 2,000 feet with those in Equipment, at \$85.00.....	1,530.00
6.	24 Extra Blank Bits, size “B,” at \$1.25.....	30.00
7.	6 Extra Core Lifters, size “B,” at \$3.15.....	18.90
8.	4 Extra Core Shells, size “B,” at \$5.00.....	20.00
9.	1 Set Carbon, 8 Stones; weight 16 karats, at \$50.00. (Price of Carbon subject to change without notice; see page 87).....	800.00
10.	1 Cross Chopping Bit, size “B”.....	7.50
11.	Setting Carbon in one of the above Blank Bits.....	8.00
12.	100 Feet Drive Pipe (or Stand Pipe), size 4 in., at \$1.00... ..	100.00
13.	1 Steel Drive Head, size 4 in.....	10.00
14.	1 Steel Drive Shoe, size 4 in.....	10.00
15.	1 Drive Pipe Chopping Bit, size 4 in.....	7.00
16.	1 Pair Drive Pipe Clamps, size 4 in.....	8.00
17.	1 Cast Iron Drive Block.....	17.00
18.	200 Feet Casing Pipe, size 2½ in., style Flush Coupling, 10-ft. lengths, at 75c.....	150.00
19.	20 Pair Protectors for 2½-in. Casing, at .50.....	10.00
20.	1 Pair Casing Pipe Clamps, size 2½ in.....	4.50
21.	1 Bushing, “B” Rods to size 2½-in. Casing.....	3.50
22.	1 Improved Long Reamer, size 2½ in.....	24.00
23.	1 Extra Reamer Face, size 2½ in.....	2.50
24.	1 Pipe Cutter, cutting Pipe to 2 in. diameter.....	2.25
25.	1 Set Pipe Stocks and Dies, threading Pipe ½ in. to 2 in. diameter	14.00
26.	2 Pair No. 13 Chain Tongs.....	12.00
27.	2 Jack Screws	14.00
28.	1 Each 7-in. Single and Double Block, with 100 ft. of 1-in. Manila Rope	8.00
29.	15 Feet of ¾-in. Chain, with Hook and Ring.....	4.00
30.	1 Flue Cleaner, Poker and Ash Hoe.....	6.25
31.	1 Shovel, 2 Crow Bars, Hand Saw, Files and Cold Chisels.	6.00
32.	1 Sledge, Pick, Auger and Ax, with Handles.....	3.50
33.	1 Extra lot of Small Pipe, Valves and Fittings, extra Packing and Waste.....	25.00
	Total price, F. O. B. Chicago.....	\$6,978.40
	Packing and Boxing for Ocean Shipment, extra... ..	70.00

Total Weight of Drill and outfit as above, about 25,000 pounds, boxed for foreign shipment.

Code Word for ordering “Detector” Drill with above outfit complete, *Xabdaulah*.

Code Word for ordering “Detector” Drill with above outfit complete, less Boiler and Pump, *Xabdebam*.

PART III

The Sullivan Rock Drills and Channeling Machines

IF SPECIALLY INTERESTED IN THIS CLASS
OF MACHINERY SEND FOR
CATALOGUE NO. 30

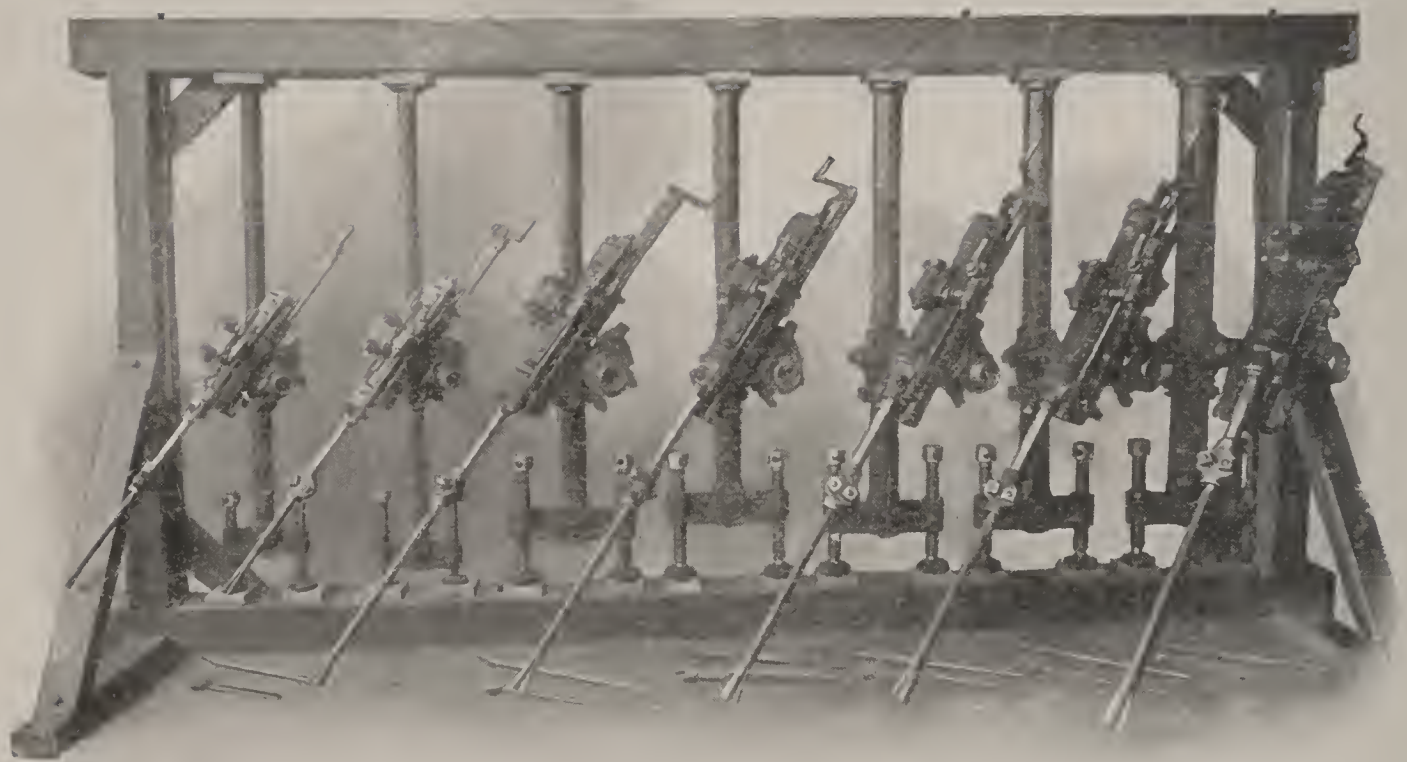


Fig. 56.

Sullivan Rock Drills, Sizes "UA" to "UF" Inclusive, Mounted on Double Screw Columns

The Sullivan Rock Drill needs no introduction in many parts of this country. Testimonials from miners, contractors and quarrymen of the highest standing will be cheerfully furnished on application. The rapid adoption of this drill in preference to all others is due to its *greater cutting capacity, greater economy of power and repairs, and greater convenience.* These advantages are secured by our unique and improved designs, which retain all the best features of older makes with greater simplicity and more economical use of power, while our higher grade of workmanship and material secure far less wear of moving parts.

For prices, weights and specifications of rock drills (unmounted) see page 132.



Fig. 57.

Sullivan "UA" Drill in Narrow Stope

Owing to the light weight of the Sullivan "U A" Drill and the ease with which it can be moved and operated by one man, it has become a great favorite in all parts of the country. For mining purposes it is usually mounted on a light column or shaft bar, and is used for sinking the smaller shafts, drifting and stoping, and is invaluable for use in small stopes, as one man can carry the drill into any part of a stope, set it up and run it himself without the aid of a helper; in this way a large number of men can be done away with and a great saving made in the cost of extracting the ore. One man with this machine will drill more feet of holes in one shift than four men with hand hammers.

Prices, Weights and Specifications of Sullivan Rock Drills (Unmounted)

LETTER INDICATING SIZE	UA	US	UB	UC	UD	UE	UF	UH	UK
Diameter of cylinder.....	2	2 $\frac{1}{4}$	2 $\frac{1}{2}$	2 $\frac{3}{4}$	3	3 $\frac{1}{8}$	3 $\frac{1}{4}$	3 $\frac{5}{8}$	4 $\frac{1}{4}$
Length of stroke, inches.....	4 $\frac{1}{2}$	5	5	6 $\frac{1}{8}$	6 $\frac{1}{2}$	6 $\frac{1}{2}$	7	7 $\frac{5}{8}$	8
Length of feed (depth drilled without changing steel) inches.....	12	15	20	24	24	24	24	30	30
Depth of hole machine will drill easily. Feet, from one to.....	4	5	6	10	12	14	16	20	28
Diameter of holes that may be drilled, in.	$\frac{5}{8}$ to 1 $\frac{3}{4}$	$\frac{7}{8}$ to 2	1 to 2 $\frac{1}{4}$	1 $\frac{1}{4}$ to 2 $\frac{1}{2}$	1 $\frac{1}{4}$ to 3	1 $\frac{1}{4}$ to 3	1 $\frac{1}{4}$ to 3	1 $\frac{1}{2}$ to 4	2 to 5
Diameter of drill steel used, inches.....	$\frac{3}{4}$ to $\frac{7}{8}$	$\frac{7}{8}$ to 1	$\frac{7}{8}$ to 1	1 to 1 $\frac{1}{8}$	1 $\frac{1}{8}$ to 1 $\frac{1}{4}$	1 $\frac{1}{8}$ to 1 $\frac{1}{4}$	1 $\frac{1}{8}$ to 1 $\frac{1}{4}$	1 $\frac{1}{4}$ to 1 $\frac{3}{8}$	1 $\frac{1}{2}$ to 1 $\frac{5}{8}$
Number of pieces in set of steel to drill holes to depth above stated.....	4	4	4	5	6	7	8	8	10
Diameter of steam inlet, inches.....	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	1	1	1	1	1 $\frac{1}{4}$	1 $\frac{1}{4}$
Size of hose to connect to drill, inches....	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	1	1	1	1	1 $\frac{1}{4}$	1 $\frac{1}{4}$
Size of steam pipe to carry steam 100 to 200 feet, inches.....	$\frac{3}{4}$	1	1	1	1 $\frac{1}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{4}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$
Size of boiler to supply steam for one drill, horsepower.....	5	6	8	8	8	10	10	12	15
Weight of drill unmounted, pounds.....	95	130	140	210	240	245	320	375	520
Shipping weight of drill boxed, pounds....	120	160	175	250	285	295	375	440	590
Price of drill unmounted.....	\$200.00	\$220.00	\$240.00	\$265.00	\$300.00	\$330.00	\$350.00	\$430.00	\$550.00
Size of tripod.....	U1 or U2	U2	U3	U3	U3 & U6	U6	U6	U7	U7
Size of mining column or shaft bar.....	U21	U21	U24	U24	U27	U27	U27	U29	U29
Code word for drill unmounted, for steam	Bajado	Bajanos	Bajesid	Bajillo	Bajith	Bajonula	Bajoujo	Bajular	Bajury
Code word for drill unmounted, for air....	Bajac	Bajam	Bajel	Baji	Bajoa	Bajoun	Bajuz	Bajuco	Bajub

Discount on drills unmounted.....

For prices, weights and specifications of mountings for attaching above drills, see pages 133 and 134.
All prices quoted are f. o. b. cars Chicago or Claremont unless otherwise stated.

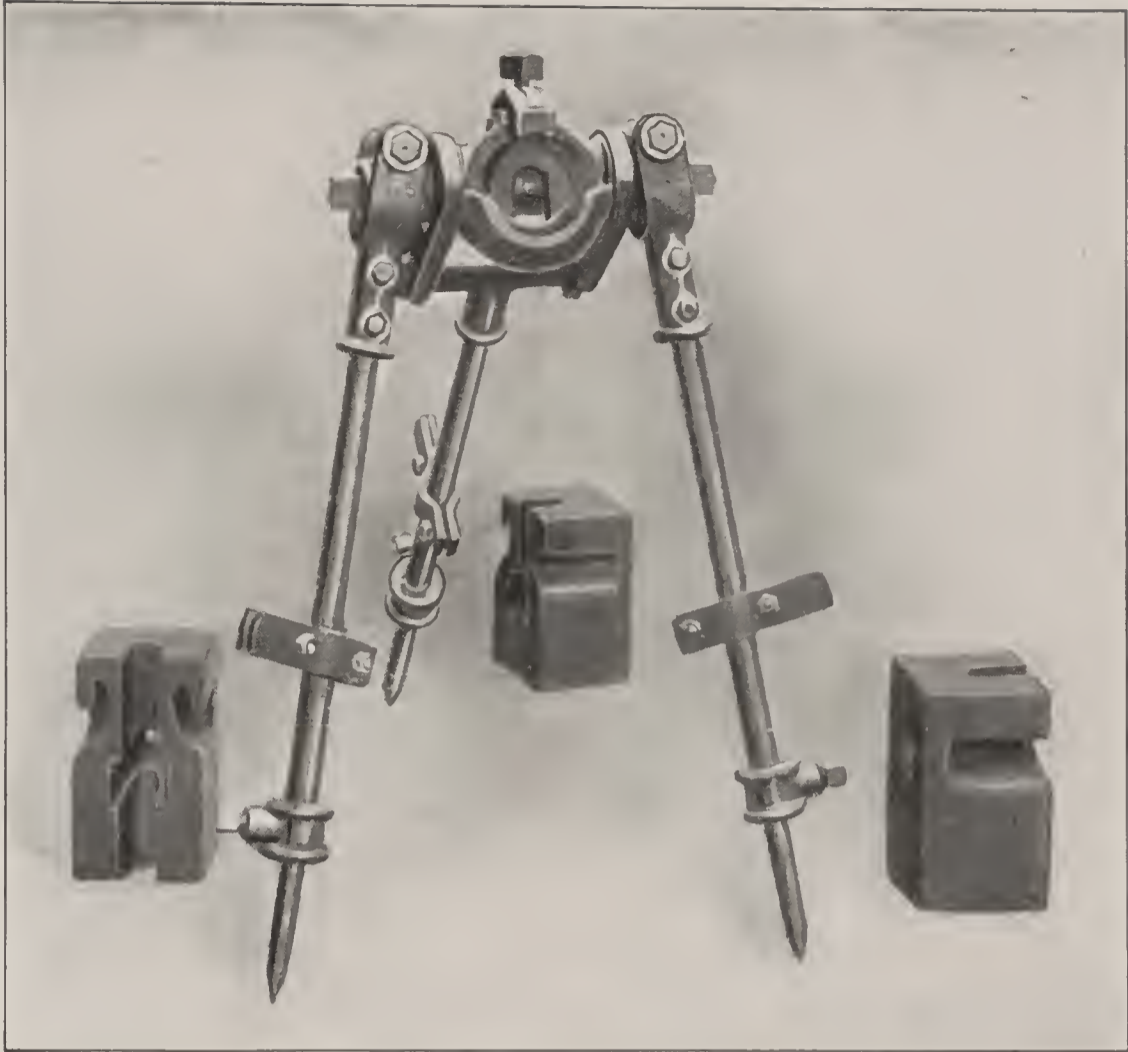


Fig. 58.

The Sullivan Adjustable Tripod: Prices, Weights and Specifications

Size	Used with Drills, Size	Weight in Pounds			Price with Weights	Code Word
		Tripod Only	(3) Weights Only	Total Shipping		
*U 1	UA	50	120	170	\$30.00	Bamboeing
U 2	UA, US	110	216	326	40.00	Bamboozle
U 3	UB, UC	200	306	506	50.00	Bamburrall
U 6	UD, UE, UF	230	342	572	55.00	Banalidade
U 7	UH, UK	345	390	735	60.00	Banality

*The U 1 Tripod is made especially as a U A Drill mounting for plug and feather work, and differs from the heavier tripods in not having the universal joint.

For prices, weights and specifications of rock drills for attaching to the above tripods see page 132.

All prices quoted are f. o. b. cars Chicago or Claremont unless otherwise stated.

Note: The U D Drill can be used on U 3 tripod if the work is light, but this mounting is not recommended for deep holes.

Prices, Weights and Specifications, Sullivan Mining Columns, Shaft and Stopping Bars

Size	Diameter of Column in Inches	Size of Drills used with the Different Columns	Single Screw Mining Column, Shaft or Stopping Bar with Saddle				Double Screw Mining Column with Adjustable Arm and Saddle				Adjustable Arm Separate		Saddle or Clamp Separate		
			6 feet in length		8 feet in length		6 feet in length		8 feet in length		Price	Code Word	Price	Code Word	
			Weight in Pounds, Column with Saddle	Code Word	Weight in Pounds, Column with Saddle	Code Word	Weight in Pounds, Column with Adjustable Arm and Saddle	Code Word	Weight in Pounds, Column with Adjustable Arm and Saddle	Code Word	Price, 6 to 8 feet in length	Price	Code Word	Price	Code Word
U21	3	UA, US	100	Bardaicos	120	Bardenkoor	165	Bardisch	180	Bashemath	\$45.00	\$10.00	Basiationi	\$12.00	Basified
U24	4	UB, UC	185	Bardaicum	215	Bardenlied	320	Bardismic	350	Basiabas	50.00	11.00	Basiator	13.00	Basifixe
U27	4½	UD, UE, UF	215	Bardajes	245	Bardennes	380	Bardling	400	Basiabo	60.00	12.00	Basiatoris	14.00	Basifugal
U29	5½	UH, UK	240	Bardandoli	280	Pardeorum	430	Bardolf	470	Basiabunt	80.00	13.00	Basiavisti	17.00	Basigenas

Discount.....

In ordering columns state minimum length required, allowing for wood blocking at both ends. The jackscrews enable the columns to be lengthened several inches.

If longer or shorter column than 6 or 8 feet is required, use code word as above, and in addition state length. We make any length columns.

For prices, weights and specifications of rock drills (unmounted) for attaching to above mining columns, shaft and stopping bars, see page 132.

All prices quoted are f. o. b. cars Chicago or Claremont unless otherwise stated.

Sullivan Mining Columns, Shaft and Stopping Bars, and Hose for Sullivan Rock Drills

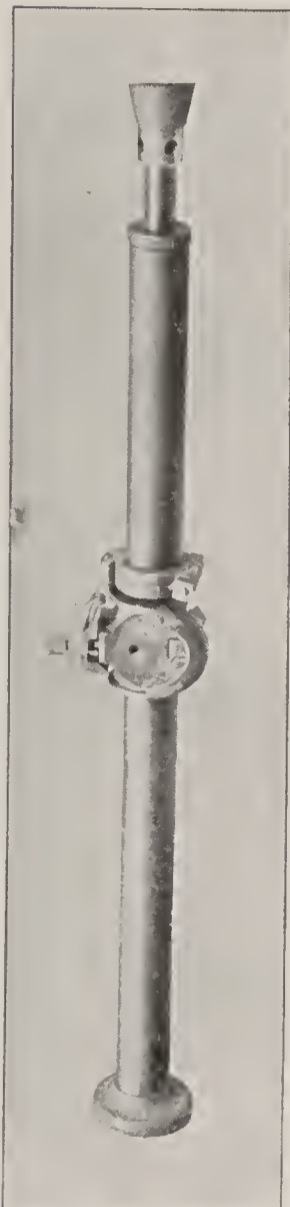


Fig. 59 Sullivan Single Screw Mining Column, Shaft or Stopping Bar, with Saddle or Clamp.

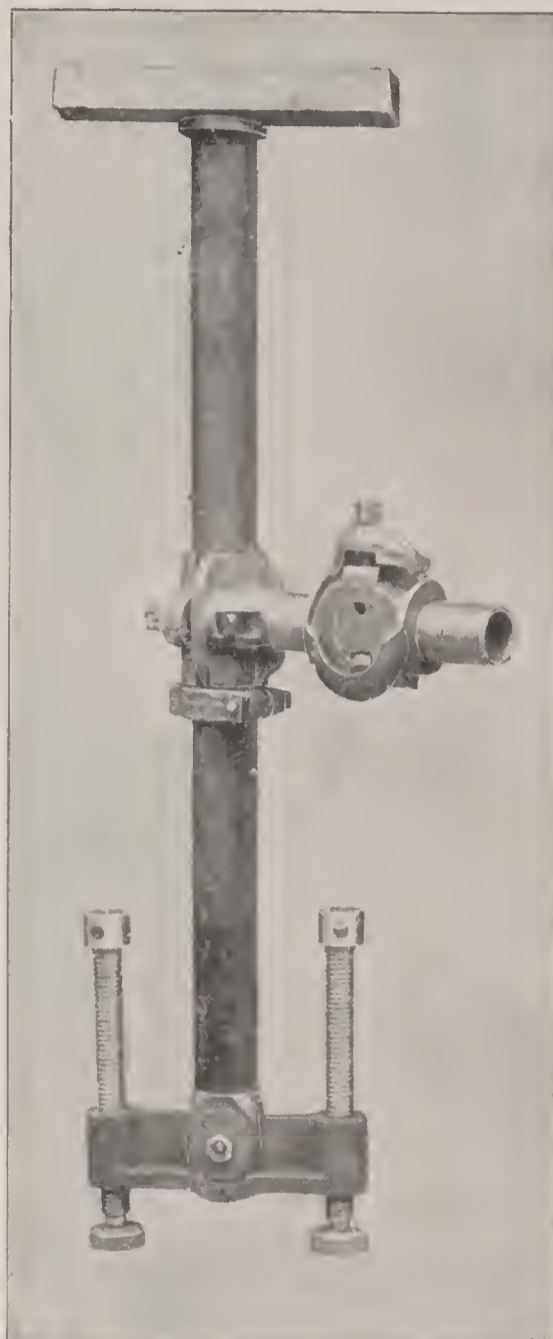


Fig. 60. Sullivan Double Screw Mining Column, with Adjustable Arm and Saddle or Clamp.

For prices, weights and specifications of Sullivan Mining Columns, Shaft and Stopping Bars, see page 134.

Drill Shank Swages

No. 7 (for anvil)	Price.....\$0.75	Code Word.....Boenlap	
No. 8 (hammer)	"75	" Boenoa	

When ordering Drill Shank Swages give diameter of shank to be swaged.

All prices quoted are f. o. b. cars Chicago or Claremont unless otherwise stated.

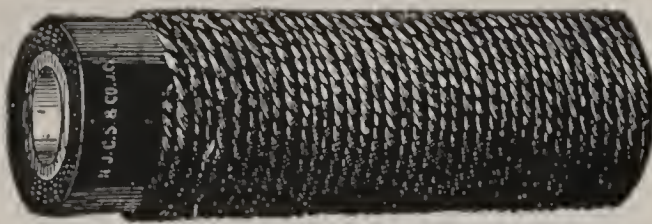


Fig. 61. Marline-Wound Hose.



Fig. 62. Wire-Wound Hose.

Prices on Marline or Wire-Wound Hose for Rock Drills

(Without Connections.)

Description	For Drills, Size	25 Feet		50 Feet	
		Price	Code Word	Price	Code Word
3/4-in., 4-ply, steam.	UA, US, UB	\$10.35	Bedelry	\$20.70	Bedilling
3/4-in., 4-ply, air . . .	UA, US, UB	9.20	Bedesman	18.40	Bedizen
1 -in., 5-ply, steam.	UC,UD,UE,UF	15.90	Bedestond	31.85	Bedjah
1 -in., 5-ply, air . . .	UC,UD,UE,UF	14.15	Bedeuten	28.30	Bedompt
1 1/4-in., 6-ply, steam.	UH, UK	24.15	Bedeutung	48.25	Bedoting
1 1/4-in., 6-ply, air . . .	UH, UK	21.45	Bedgenoot	42.90	Bedroog

Discount.....

(With Connections.)

Description	For Drills, Size	25 Feet		50 Feet	
		Price	Code Word	Price	Code Word
3/4-in., 4-ply, steam.	UA, US, UB	\$13.75	Bedtafel	\$24.10	Bellator
3/4-in., 4-ply, air . . .	UA, US, UB	12.60	Beduidsel	21.80	Bellatrix
1 -in., 5-ply, steam.	UC,UD,UE,UF	20.40	Beduinas	36.35	Bellatuli
1 -in., 5-ply, air . . .	UC,UD,UE,UF	18.65	Bellabunt	32.80	Bellhase
1 1/4-in., 6-ply, steam.	UH, UK	29.25	Bellacem	53.35	Bellhund
1 1/4 in., 6-ply, air . . .	UH, UK	26.55	Bellacity	48.00	Belliatos

Discount.....

All prices quoted are f. o. b. cars Chicago or Claremont unless otherwise stated.

Marline-Wound Hose is always furnished unless order specifies differently.

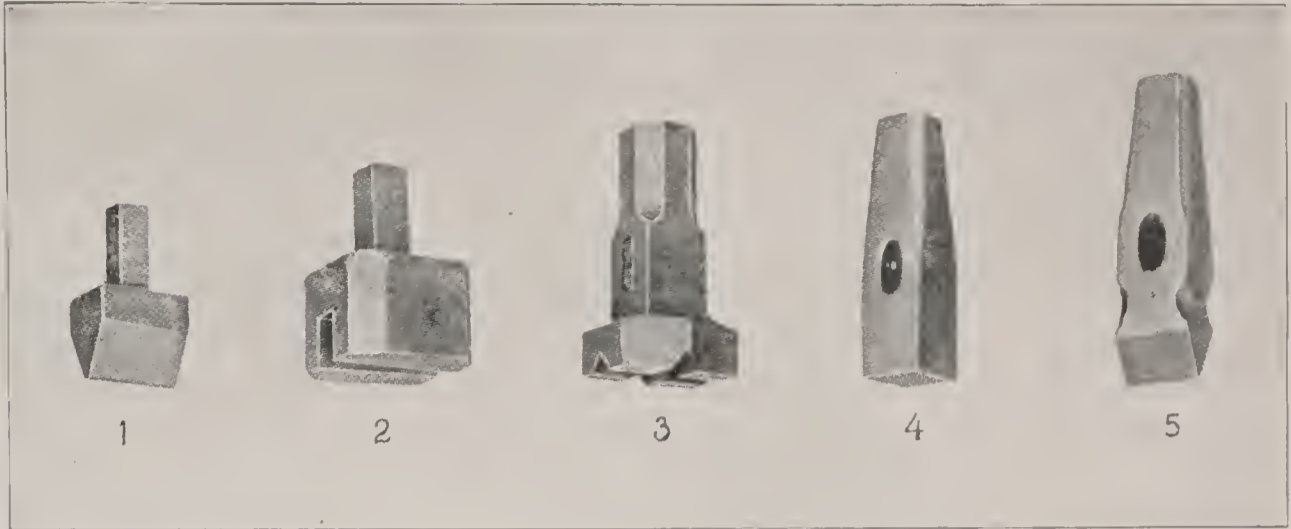


Fig. 63.

Blacksmith's Tools for Forging Drill Steel

Name	For "US" to "UK" Drills			For "UA" Drill Only		
	Number	Price	Code Word	Number	Price	Code Word
Swage	1	\$1.25	Birliana	11	\$1.25	Boekband
Sow	*2	2.75	Birling	12	2.50	Boekdeel
Dolly + (See Note)	3	3.00	Birlonga	13	2.50	Boekhaak
Flatter.....	4	1.50	Birnkopf	14	1.25	Boekweit
Spreader	5	1.50	Birnmuss	15	1.50	Boekworm
Per set		10.00	Birsche		9.00	Boemund

NOTE. × shaped dolly for "U S" to "U K" Drill Steel is No. 6, and for "U A" Drill Steel No. 16 + shaped dollies are always furnished unless the × are ordered.

If × dolly is wanted use the prefix "Ex" to code word.

*When ordering "Sow" give size of steam drill the steels are to be used with.



Fig. 64.

Hand Pumps

Outside diameter	7/8-in.	1-in.	1 1/4-in.	1 1/2-in.	1 5/8-in.
Price, 2 feet long.....	\$1.00	\$1.00	\$1.25	\$1.50	\$1.50
Code word.....	Besuconas	Besugadas	Besugos	Besuguete	Besuqueis
Discount.....					



Fig. 65.

Sullivan Hose Connections

Size	$\frac{3}{4}$ -in.	1-in.	$1\frac{1}{4}$ -in.
Price per set.....	\$3.40	\$4.50	\$5.10
Code word.....	Bellicous	Bellidis	Bellienus

Discount.....

Note: The pieces shown in Fig. 66 constitute a "set."

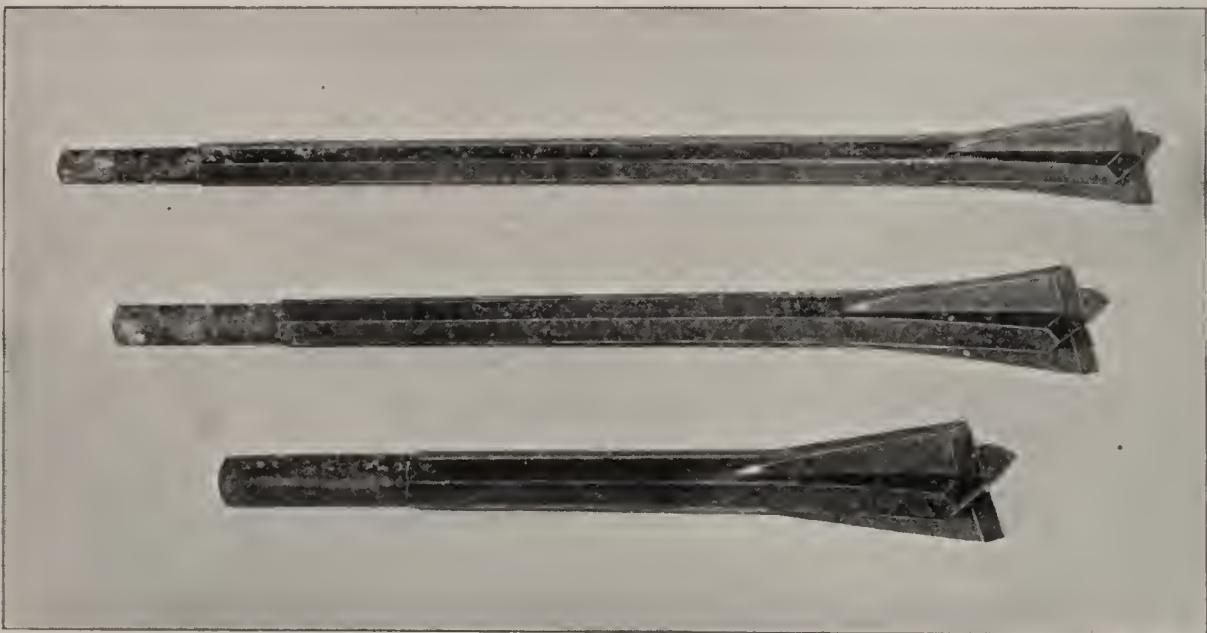


Fig. 66.

Drill Steels

For prices, weights and specifications, see pages 139 and 140.

All prices quoted f. o. b. cars New York unless otherwise stated.
wise stated.

Prices, Weights and Specifications of Drill Steels for Sullivan Rock Drills (Formed and Sharpened, but not Tempered)

For Drill "UA"—2 Inches							For Drill "US"—2¼ Inches					
Feed 12 Inches							Feed 15 Inches					
Size of Shank ¾ in. x 3¾ in.							Size of Shank ¾ in. x 4 in.					
Regular Size of Gauge	Length Steel will Cut	Name of Each Length	Size of Steel	Weight in Lbs.	Price		Regular Size of Gauge	Length Steel will Cut	Size of Steel	Weight in Lbs.	Price	
					Single	Set					Single	Set
1½	1'0"	Starter	7/8"	3½	\$1.45	.....	1¾	1'3"	1"	5	\$1.60	.....
1⅜	2'0"	2d lgth	7/8"	5	1.75	\$3.20	1⅝	2'6"	1"	9	2.00	\$3.60
1¼	3'0"	3d lgth	¾"	6	2.00	5.20	1½	3'9"	7/8"	10	2.20	5.80
1⅛	4'0"	4th lgth	¾"	7½	2.25	7.45	1⅜	5'0"	7/8"	13	2.55	8.35
1	5'0"	5th lgth	¾"	9	2.50	9.95	1¼	6'3"	7/8"	16	2.90	11.25
Code word, set to 3'.....Betaalde							Code word, set to 3'9".....Betagt					
" " 4'.....Betaculi							" " 5'0".....Betakelen					
" " 5'.....Betaculus							" " 6'3".....Betalter					

For Drill "UB"—2½ Inches							For Drill "UC"—2¾ Inches					
Feed 20 Inches							Feed 24 Inches					
Size of Shank ¾ in. x 4¼ in.							Size of Shank 1 in. x 4½ in.					
Regular Size of Gauge	Length Steel will Cut	Size of Steel	Weight in Lbs.	Price		Regular Size of Gauge	Length Steel will Cut	Size of Steel	Weight in Lbs.	Price		
				Single	Set					Single	Set	
1¾	1'8"	1"	7	\$1.85	.....	2⅛	2'0"	1⅛"	10	\$2.20	.....
1⅝	3'4"	1"	11	2.10	\$ 3.95	2 "	4'0"	1⅛"	18	3.10	\$ 5.30	
1½	5'0"	7/8"	13	2.55	6.50	1⅞	6'0"	1 "	20	3.20	8.50	
1⅜	6'8"	7/8"	17	3.00	9.50	1¾	8'0"	1 "	25	3.75	12.25	
1¼	8'4"	7/8"	21	3.50	13.00	1⅝	10'0"	1 "	30	4.40	16.65	
.....	.....	.....	.....	.....	.....	1½	12'0"	1 "	35	4.95	21.60
Code word, set to 5'0".....Beterschap							Code word, set to 6'0".....Bicorpor					
" " 6'8".....Biconge							" " 8'0".....Bicural					
" " 8'4".....Biconvexo							" " 10'0".....Biuculle					
							" " 12'0".....Bicuda					

For Drill "UD"—3 Inches							For Drill "UH"—3½ Inches					
For Drill "UE"—3⅝ Inches							Feed 30 Inches					
For Drill "UF"—3¾ Inches							Size of Shank 1¼ in. x 5½ in.					
Feed 24 Inches							Feed 30 Inches					
Size of Shank 1⅛ in. x 4¾ in.							Size of Shank 1¼ in. x 5½ in.					
Regular Size of Gauge	Length Steel will Cut	Size of Steel	Weight in Lbs.	Price		Regular Size of Gauge	Length Steel will Cut	Size of Steel	Weight in Lbs.	Price		
				Single	Set					Single	Set	
2½	2'0"	1¼"	11	\$2.30	.....	3 "	2'6"	1⅜"	18	\$ 2.95	.....
2⅜	4'0"	1¼"	19	3.30	\$ 5.60	2⅞	5'0"	1⅜"	32	4.45	\$ 7.40	
2¼	6'0"	1⅛"	23	3.75	9.35	2¾	7'6"	1¼"	37	5.05	12.45	
2⅛	8'0"	1⅛"	31	4.50	13.85	2⅝	10'0"	1¼"	48	6.40	18.85	
2 "	10'0"	1⅛"	39	5.30	19.15	2½	12'6"	1¼"	59	7.60	26.45	
1⅞	12'0"	1⅛"	47	6.15	25.30	2⅜	15'0"	1¼"	70	8.65	35.10	
1¾	14'0"	1⅛"	55	7.05	32.35	2¼	17'6"	1¼"	81	9.95	45.05	
1⅝	16'0"	1⅛"	63	7.90	40.25	2⅛	20'0"	1¼"	92	11.30	56.35	
Code word, set to 10'0".....Bidbank							Code word, set to 12'6".....Bidplaats					
" " 12'0".....Biddende							" " 15'0".....Bidstond					
" " 14'0".....Bidelle							" " 17'6".....Biquejar					
" " 16'0".....Bidelulf							" " 20'0".....Biquinho					

Prices, Weights and Specifications of Drill Steels for Sullivan Rock Drills (Continued)

For Drill "UK"—4¼ Inches					
Feed 30 Inches					
Size of Shank 1½ in. x 6 in.					
Regular Size of Gauge	Length Steel will Cut	Size of Steel	Weight in Lbs.	Price	
				Single	Set
3⅝"	2'6"	1⅝"	27	\$ 4.26	.....
3½"	5'0"	1⅝"	47	5.86	\$ 10.12
3¾"	7'6"	1⅝"	66	7.38	17.50
3¼"	10'0"	1½"	74	8.00	25.50
3⅛"	12'6"	1½"	90	9.30	34.80
3"	15'0"	1½"	107	10.70	45.50
2⅞"	17'6"	1½"	123	11.94	57.44
2¾"	20'0"	1½"	140	13.30	70.74
2⅝"	22'6"	1½"	156	14.58	85.32
2½"	25'0"	1½"	174	16.00	101.32
2⅜"	27'6"	1½"	190	17.30	118.62

Code word, set to	20' 0"	.....	Birkens
"	"	22' 6"	Birkwein
"	"	25' 0"	Bialaba
"	"	27' 6"	Birlabais

Steels for Broaching

For prices of special "broaching" steels and bits, add one-third ($\frac{1}{3}$) to the prices of regular drill steels.

Discount on Drill Steel

All prices quoted are f. o. b. cars Chicago or Claremont unless otherwise stated.

State whether + or X bits are wanted, and also give gauge or size hole required.

Note: Regular gauge as above, with + bits, will be furnished unless otherwise directed.

As the temper of drill steels varies according to the hardness of the rock, we send them out untempered; thus allowing the local blacksmith to temper them to suit the special conditions.

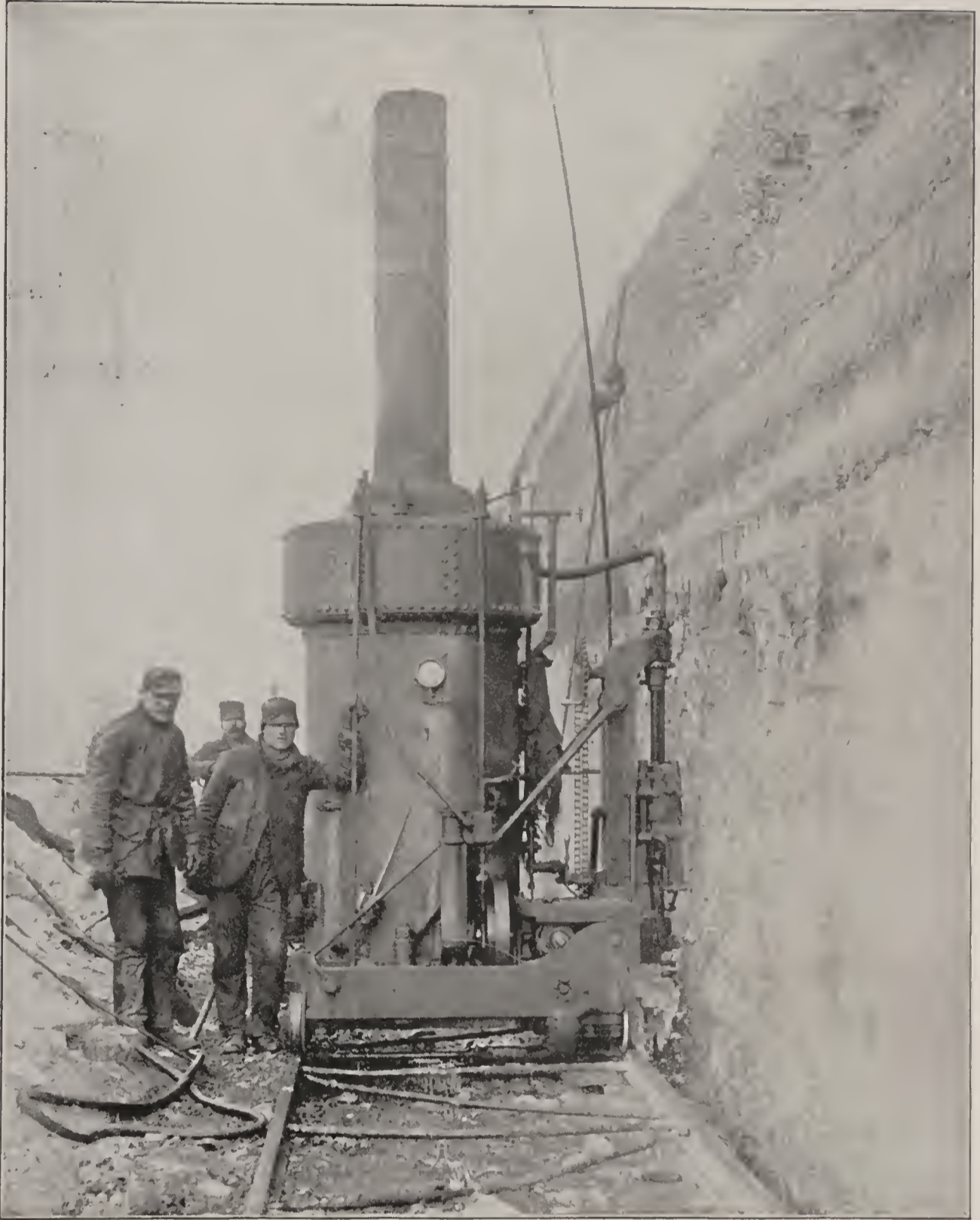


Fig. 67. Sullivan Channeler with Boiler

The Sullivan Steel Gang Channeling Machine

During the past ten years the Sullivan Steel Gang Channeling Machine has become well known in the principal quarrying regions of the country, where it has made records surpassing those of any channeling machine hitherto manufactured. The principal features of the Sullivan Channeler are its high cutting capacity, which has

never been equaled; its low cost of operating expenses in labor, fuel and repairs; and many features of design, construction and operation which add to its efficiency, simplicity and convenient handling.

We build several styles of this channeler, with or without boiler, with swiveling or rigid head, for level or inclined track. Each channeler is provided with a complete outfit, consisting of track, lifting sling, eight gangs of drills, piping, tools and supplies, and including extra bolts, piston rings, and other items sufficient to run the machine a long time without repairs.

The Sullivan channeler is adapted to all kinds of stone, having been used extensively in marble, sandstone and limestone in Vermont, New York, Georgia, Tennessee, Indiana, Colorado and elsewhere.

The specifications for the rock-work on the great Drainage Canal, running from Chicago to Joliet, Ill., required that the walls in the rock sections be channeled. This work presented new conditions in the use of channeling machines, owing to the broken condition of the rock formation, and its irregularity; being hard in some places and soft and pockety in others. The Sullivan Channeler successfully overcame all these difficulties, and was the acknowledged standard Channeling Machine on this piece of work, twice as many Sullivan Channelers being used as of all other kinds.

The Development of the Use of Channeling Machines on Public Work

Until channeling machines came into notice in connection with the Chicago Main Drainage Canal work they were comparatively unknown to the civil engineering profession. They had been used for years in the quarries of the country, but had rarely, if ever, been thought of as serviceable for anything except the economical quarrying of valuable stone. The Drainage Canal work has changed all this and has demonstrated to the engineers of this country that a channeling machine must take its place with the air compressor and rock drill, as one of the established tools for carrying on important rock-work.

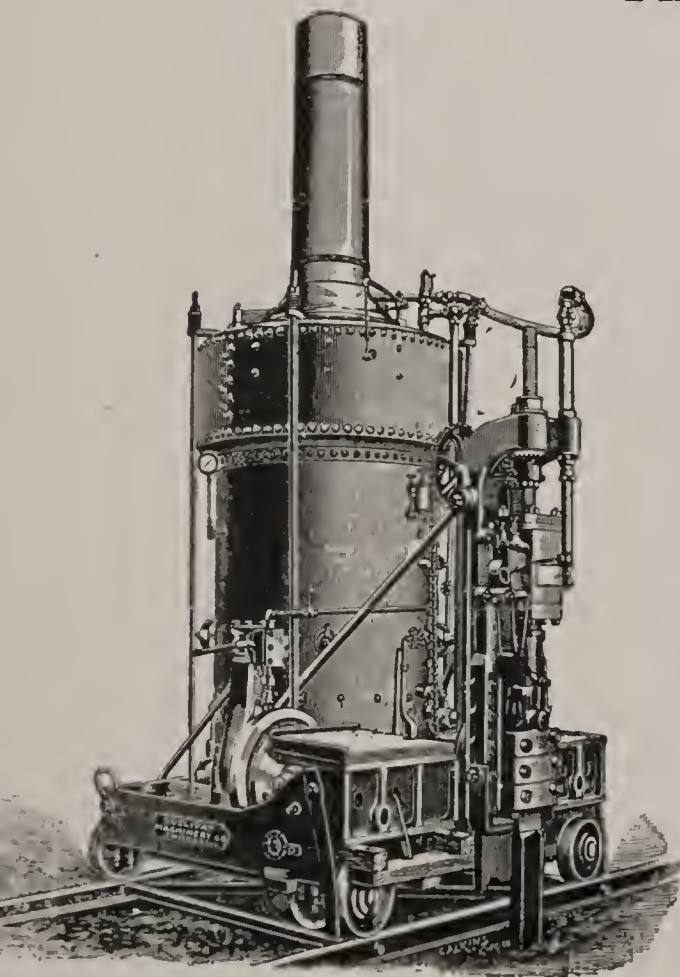


Fig. 68.

The main advantages secured by the use of the channeler on engineering work are: *Firstly*, that the channel cut enables the material within the side lines of the excavation to be blasted and removed without any disturbance of the wall or material outside of the lines of the cuts. In this way excavation in rock can be carried on directly up to walls of masonry, building foundations, etc., without disturbing the existing structure. *Secondly*, the same causes that accomplish the results above described insure an unshaken wall outside the line of excavation. Where the ordinary process is adopted of drilling and blasting, without channeling the sides, the effect of the explosive tends to shatter the side walls, often some distance beyond the lines of excavation, giving a chance for the action of water and frost, and causing expense and liability to damage from pieces of rock shelling off each season. *Thirdly*, the use of these machines enables rock excavations to be carried to great depths with unshaken walls and without the necessity of removing any surplus material. See pages 146 and 147.



Fig. 69. Size No. 6½, Without Boiler. Making an Angle Wall Cut.

The Sullivan Swivel Head Channeler

The engraving on preceding page shows the limiting angle with this machine with regular braces, but with special back braces the angle can be increased.

The equipment for this machine, which is included in price, is shown on page 145.

For prices, weights and specifications, see page 145.

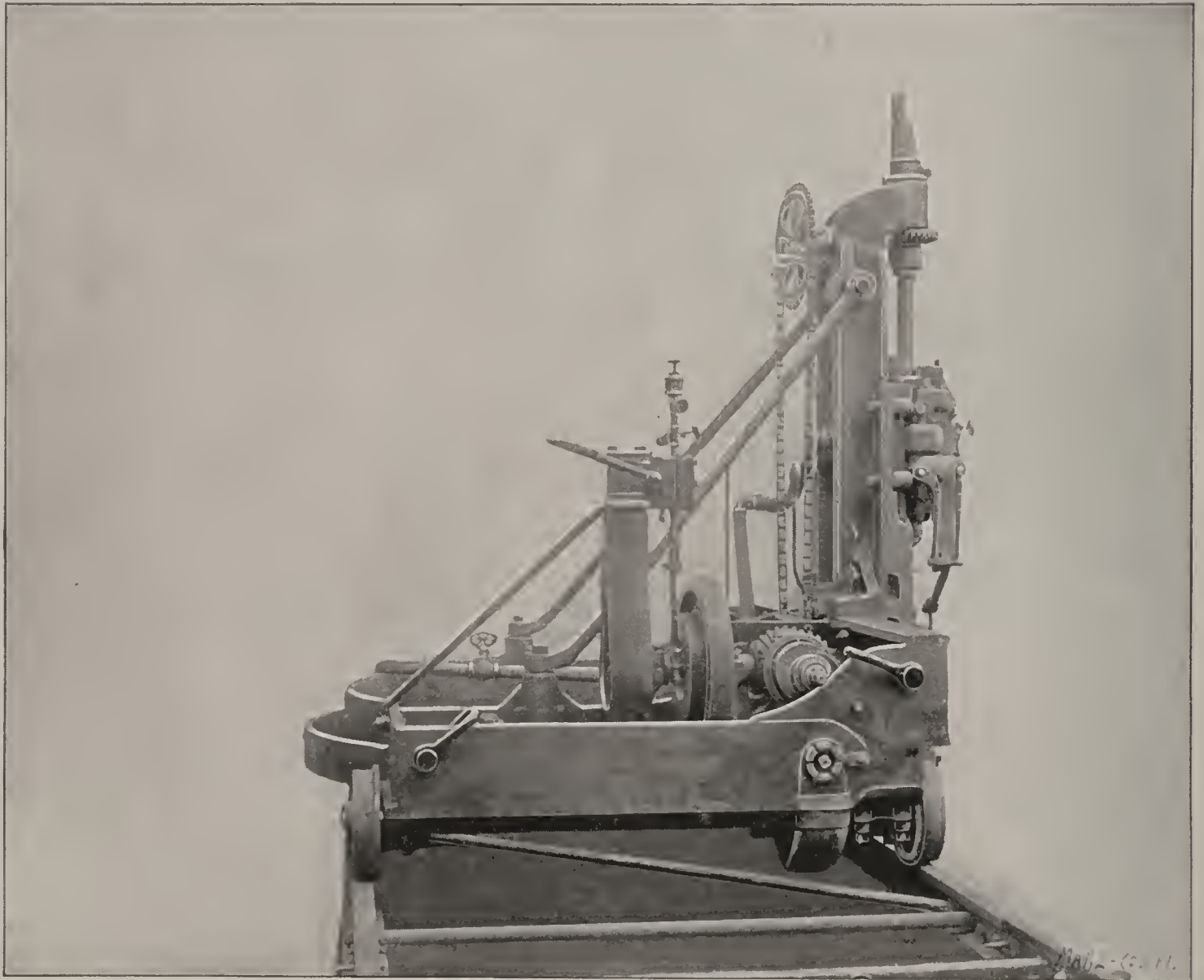


Fig. 70. Size Y, Without Boiler.

The Sullivan Rigid Head Channeler For Vertical Cutting

The equipment for this machine which is included in price, is shown on page 145.

For prices, weights and specifications, see page 145.

Equipment for Sullivan Channelers

The following general equipment is provided with each Channeler, and is included in price.

Iron square, drill gauge and straight edge.	Extra clamp bolts, nuts and set-screws.
Hatchet and hammer, level and files.	Extra springs and pins for reverse valve.
Oil cans and lubricators.	Extra piston packing.
Hand clamp to hold drills.	Packing and waste.
Track braces.	Footboard for operator.
Scoops and pointing drills for channels.	Crank to move machine by hand.
Wood wedges for track.	Monkey and pipe wrench and complete set of solid wrenches.
Iron blocking for drills.	Steel for eight gangs of drills, two each, 34-inch, 52-inch, 70-inch, and 88 inches long.
Extra valve connection pins.	Three 12-foot and one 6-foot section of track.
Extra piston rings.	Lifting sling to handle machine.
Extra gaskets for swivel pipe joints.	
Extra gibs for crosshead (for 6½ machines only).	

For channelers with boilers the following equipment is added:

Bracket for water barrel.	Complete boiler fittings, including injector, gauge cocks, safety valve, pressure gauge, lubricator, exhaust and suction hose.
Ash hoe and poker.	

For channelers without boiler the following equipment is added:

Swinging steam pipes, with swivel joints and rocker shaft.

For "side hill" channelers the following equipment is provided in addition to that furnished with channelers without boiler:

Balance car and weights.	Wire rope.
Sheave wheel.	Three extra sections track for balance car.

Prices and Weights of Sullivan Channelers

TYPE	Size	Diam. of Cylinder in Inches	Weight of Machine in Pounds	Weight of Equipment in Pounds	Total Weight of Outfit in Pounds	Price	Code Word
Rigid head with boiler . . .	6½	6½	8,500	4,500	13,000	\$1,800	Dameggi
Rigid head without boiler..	6½	6½	6,300	4,500	10,800	1,600	Damenflor
Rigid head with boiler	Y	7	11,100	4,500	15,600	2,000	Damenhut
Rigid head without boiler..	Y	7	7,600	4,500	12,100	1,750	Damenthee
Swivel head with boiler . . .	6½	6½	8,700	4,500	12,500	2,100	Damenuhr
Swivel head without boiler	6½	6½	6,500	4,500	10,300	1,900	Damenwelt
Swivel head with boiler . . .	Z	7	13,200	4,500	16,700	2,250	Damhout
Swivel head without boiler	Z	7	9,700	4,500	13,200	2,000	Damianista
Side hill without boiler . . .	VX	4	1,800	2,750	4,550	1,200	Damigella
Side hill without boiler . . .	6½	6½	3,400	8,200	*11,600	2,200	Damigiana
Undercutting with't boiler	VA	3⅝	3,000	1,700	4,700	1,000	Damippus
Undercutting with't boiler	VD	7	8,100	4,500	12,600	2,250	Damisela

*Of this, balance car weights and rope weigh 3,600 pounds.

Above prices are net f. o. b. cars, Claremont, N. H.



Fig. 71. Great Bend at Romeo, Ill., Chicago Main Drainage Canal, Showing Rock Walls Channeled with the Sullivan Channelers.

The Chicago Main Drainage Canal

The Chicago Main Drainage Canal was the first piece of public work of any magnitude into the construction of which the use of channeling machines has entered. Two purposes were accomplished by the use of these machines; a smooth rock wall was secured, which greatly lessens the friction of the flow of water through the channel, and the walls were left solid. The walls being entirely unshattered by explosives, there can be no chance for the action of the elements; and they will stand without requiring any attention or expense, as long as the canal is used.

Fifteen miles of this canal were excavated through rock, and both sides were channeled, the rock sections varying from ten to thirty-six feet in depth. Fifty-five Sullivan Channelers were used on this work. The first channeler sold on the canal was a Sullivan, as were the last three; showing the reputation this machine held on the work.

The duty required of these machines on this work was very severe, as the rock was "wild," and badly shattered. In many places mud pockets were encountered, from a foot to thirty or forty feet in length, and extending in some cases to the bottom of the excavation. The depth of the channel cuts was in many instances from twelve to fifteen feet, bringing a severe strain on the machine where the formation was loose or broken.



Fig. 72. View Looking Away from Power House.

Wheel Pit Extension for Cataract Construction Co., Niagara Falls, N. Y.

Six Sullivan Channelers were used on this work. Checks in rock wall for cast iron brackets were cut with a Sullivan Gadder.

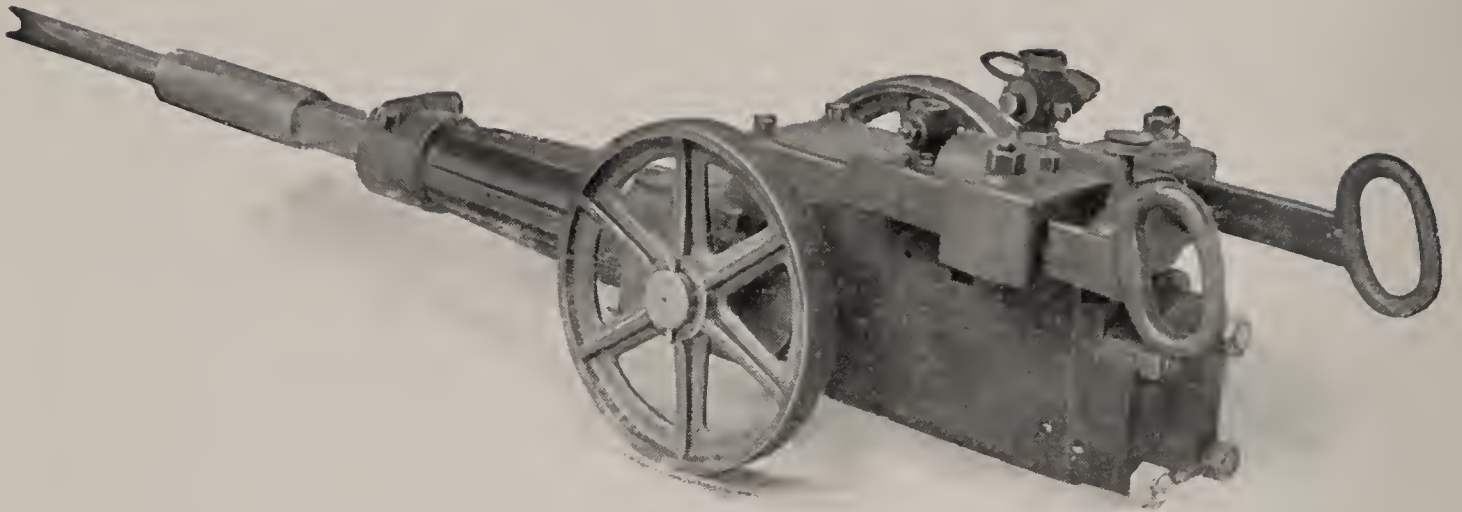


Fig. 73. Sullivan Direct-Acting Mining Machine: Class I. Weight 800 lbs.
Depth of Undercut 5 feet 6 inches.

Sullivan Coal Mining Machines

Being firm believers that the use of Coal Mining Machinery will largely increase in the near future, we have spared no expense in putting out a most complete line of machinery to meet the varying conditions. To demonstrate the increase in the use of mining machines, we quote the following from the report of the United States Geological Survey: In 1891 only 5.49 per cent of the coal mined in the United States was by the use of machines. During 1897 this product had increased to 15.95 per cent, or almost three times as great a per cent as in 1891. The number of firms using machines increased in the same time from 51 to 211, while the amount of coal mined by the use of machines increased from 6,211,732 tons to 22,649,220 tons. During this time the total product of the United States increased 29,888,665 tons, of which 16,437,488 tons represented the increase of machine mined coal. A careful study of the above figures, and a comparison of his own experience in the gradual decrease in the selling price of his product during the same time, will convince the most conservative operator of the utility of mining machines in reducing the cost of producing coal. If machines have cheapened the cost of your neighbor's coal they will certainly do the same for you.

In presenting the Sullivan Mining Machines we believe they have no equals in the rapid and economical mining of coal. The workmanship and material are of the best, and the Sullivan has many new and valuable improvements over other machines now in use. The Sullivan Undercutter, shown above, is a marked improvement; its valve motion is peculiar to itself, semi-positive and fitted with an adjustable cut-off for varying air pressures. The machine has *no leather*

or rubber cushions to wear out, it *uses exhaust air*, the best and cheapest cushion. All joints are scraped or ground, and *no gaskets* are used upon the machine.

The Sullivan Shearer is a modification of the Undercutter, self held, and the only machine making the shearing of coal rapid and profitable.

Repairs on these machines are reduced to a minimum. Moving parts are few in number and present large wearing surfaces, made with an allowance for wear.

List of Sullivan Coal Mining Machines

Class 1. **Sullivan Direct Acting Undercutter.** Depth of undercut, 5 feet 6 inches; weight 800 pounds.

Class 2. **Sullivan Direct Acting Undercutter.** Depth of undercut, 5 feet 6 inches; weight 700 pounds.

Class 3. **Sullivan Direct Acting Undercutter.** Depth of undercut, 4 feet 6 inches; weight 500 pounds.

Class 4. **Sullivan Direct Acting Undercutter.** Depth of undercut, 6 feet; weight 800 pounds.

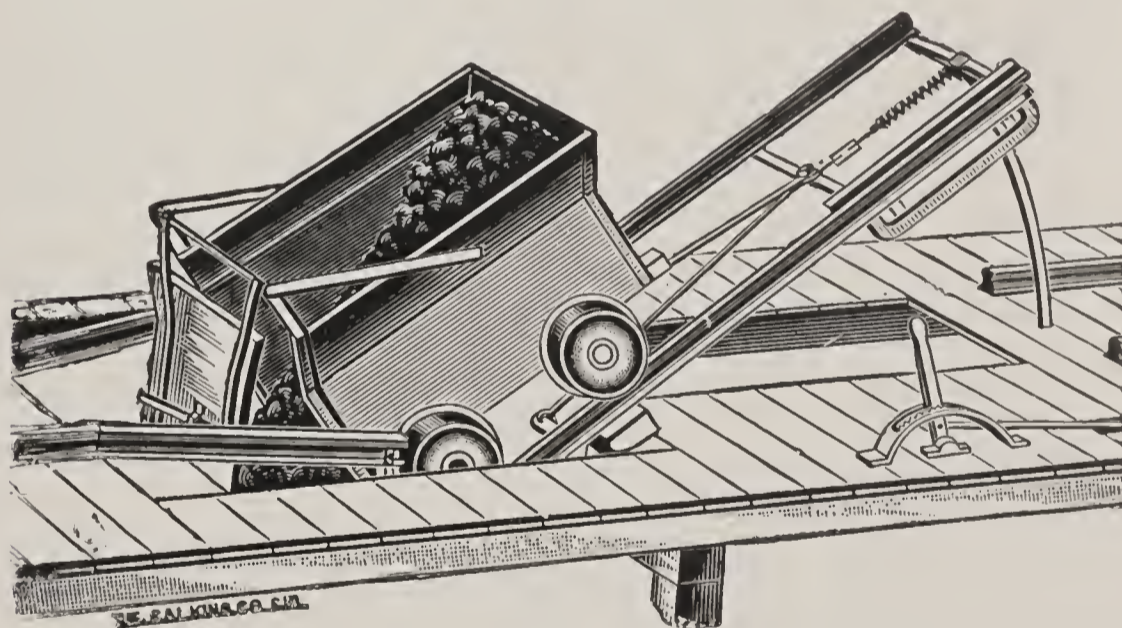


Fig. 74.

The Mitchell and Wilson Automatic Cross-over Pumps

We would respectfully call attention to the merits of the Mitchell and Wilson Automatic Cross-over Dumps. By their use the capacity of any mine can be largely increased, with a reduction of operating expense, with a decided increase in percentage of lump coal to screenings, and with an improved appearance of coal in car.

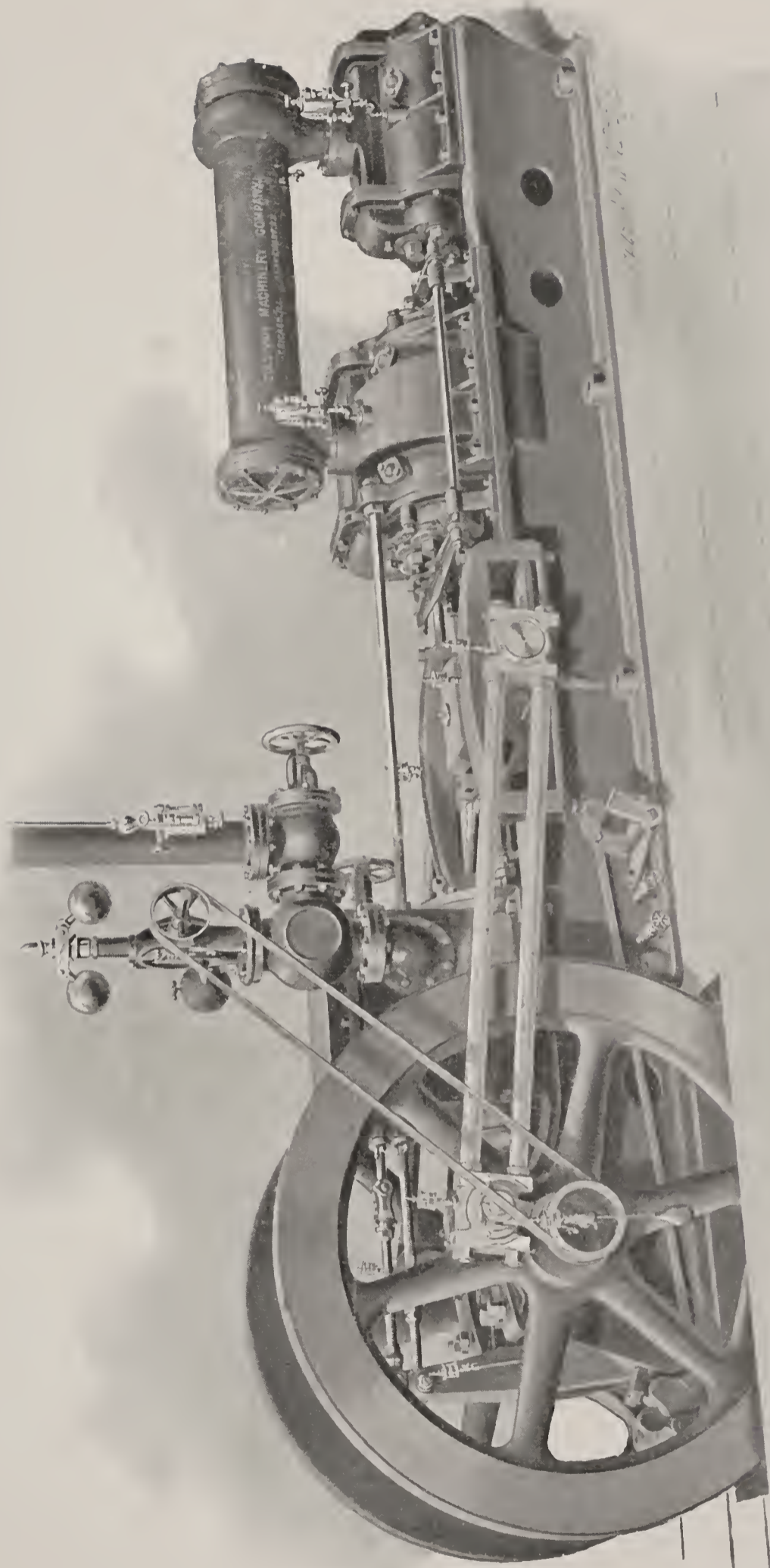
One man at the tipple can dump all the coal that can be brought to him, actual runs of over 4,000 tons of screened coal having been made over one of these machines in ten hours.

The Dump is entirely under control of the dumper, so that the coal, instead of being thrown into the chute and over the screens in a body, as with the ordinary dump, is dumped gradually, allowing thorough screening, and reducing the breaking of coal to a minimum.

This machine is simple in its construction and built especially to stand hard service. With the aid of blue prints furnished with every dump sent out, a mine carpenter can construct a new platform with grades to suit the requirements of the dump, or can rearrange grades on tipple already built.

If further information is desired special catalogues will be sent upon application.

In writing us the customer should mention whether detail sheets are desired covering the Mitchell or the Wilson Dumps.



Sullivan Straight Line Air Compressor
We manufacture a complete line of Air Compressors and Corliss Engines. *Send for Special Catalogues.*

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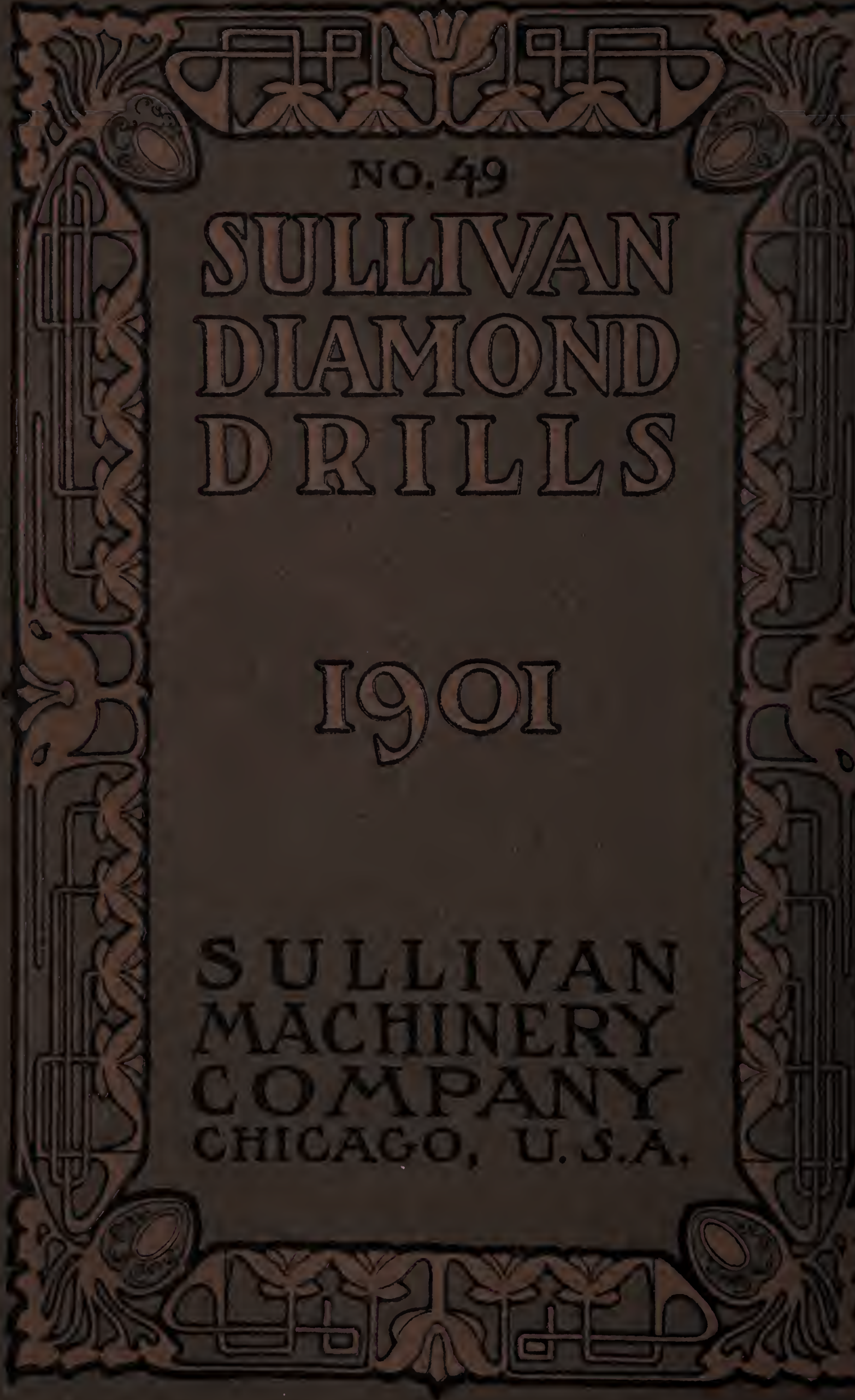
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