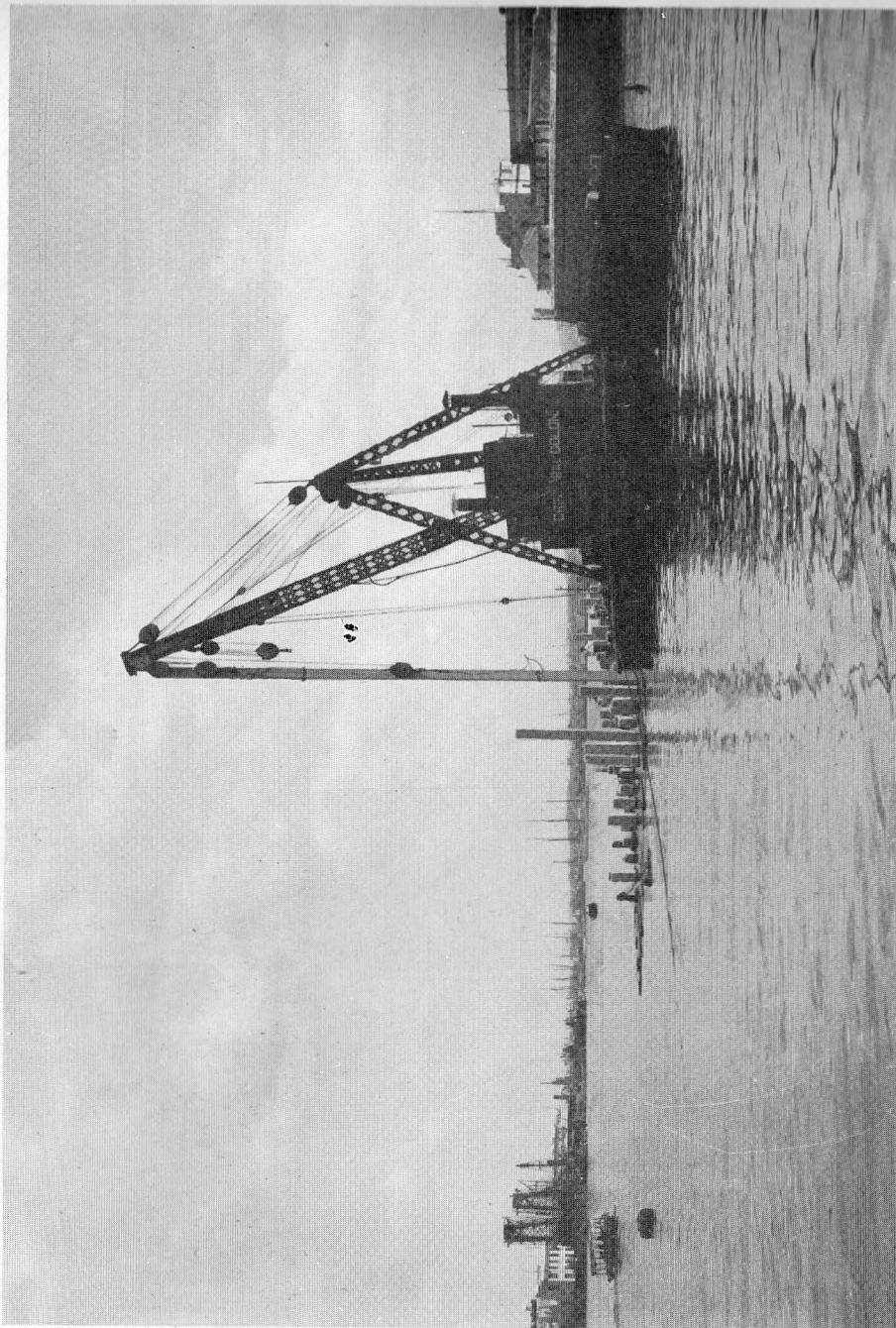


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DRIVING HEAVY CONCRETE PILES for a marine driveway being constructed at Havana, Cuba. Arellano y Mendoza, the contractors, selected two No. 0 Warrington-Vulvan steam hammers for this work. Piles shown are 20 inches square and 90 feet long.

California Pile Hammer

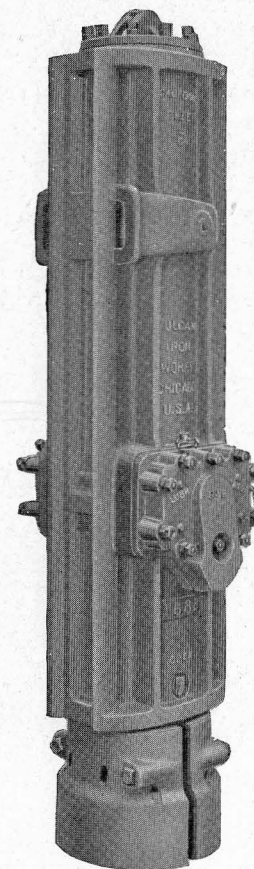
DOUBLE-ACTING—COMPOUND

Patented

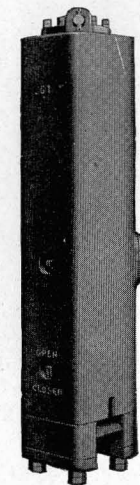
This is an entirely new and distinct type of double-acting hammer in which the partially expanded steam, which has been exhausted from the upward stroke, is again used, with further expansion, as a driving force on the top of the ram for the downward stroke, thus making the hammer compound in steam action and effecting a very appreciable saving in the amount of steam required for its operation.

The compound feature of the **CALIFORNIA HAMMER** lends itself admirably towards securing the desired action and results, as in this machine, a much lower pressure than the initial pressure is used for the down stroke, thus limiting the velocity of impact and permitting a great increase of weight in the ram itself, so that in this new hammer the Vulcan Iron Works is enabled to offer to pile-driver operators

A double-acting steam hammer with a **LOW VELOCITY BLOW FROM A HEAVY MASS OF RAM** and having the added feature of a **POSITIVELY ACTUATED VALVE**.



Sizes E and F



Size G

Three sizes, only, of the California hammer, are at present ready for the market—sizes E, F and G. All three can be operated with either steam or air, no changes or adjustments being required with either form of power.

While the hammers are designed for a working pressure of 85 pounds, they will operate at any pressure between 40 and 110 pounds with a corresponding range of energy. With the throttle wide open the full pressure is used and the full blow obtained, but by a partial closing of the throttle valve the rapidity of succession of blows and the length of the stroke may be lessened and the blow thus made softer.

The California hammer is short in over all length, permitting its use in confined situations; it is compact, rugged and simple, the entire cylinder or body is a single casting and all moving parts are enclosed within it.

The mechanically actuated valve is of the "slide valve" type with multiple ports, its travel is short, it is incapable of derangement and no adjustment is ever necessary.

The piston or ram is in one piece, it strikes directly upon the impact plate; there are no stuffing boxes or glands; in fact, no attendance is required by the operator other than to manipulate the throttle, the lubricator and the drain cocks.

With each hammer there is furnished a throttle valve, hose and couplings, lubricator, drain valve, drain cocks and wrenches. The throttle valve may be used at either end of the hose.

The size "G" California hammer is primarily designed for use in driving sheet piling and is arranged for use without leaders. The larger sizes "F" and "E" are provided with integrally cast jaws and are intended to be used with leaders but at the option of the operator, may be used without leaders. When used without leaders the hammer may be suspended from a derrick boom or any other convenient device, the hammer is lowered on top of the pile until its full weight rests thereon, steam or air is then turned on, and as the pile and hammer descend, the tackle line is slackened off just enough to maintain the hammer in a vertical position. If used with leaders, it is only necessary to lower the hammer on to the pile and slacken the hoisting line.

When using either method the full weight of the hammer must rest upon the pile during the entire operation.

"A Low Velocity Blow from a Heavy Mass of Ram"

The statements on page 3 apply to the double-acting form just as definitely as they do to the single-acting form of steam pile hammer. The blow of the hammer must be from a heavy mass of ram, sufficient not only to overcome the inertia of the pile and its frictional resistance, but over and above that, the ram must have surplus weight to impart motion to the pile.

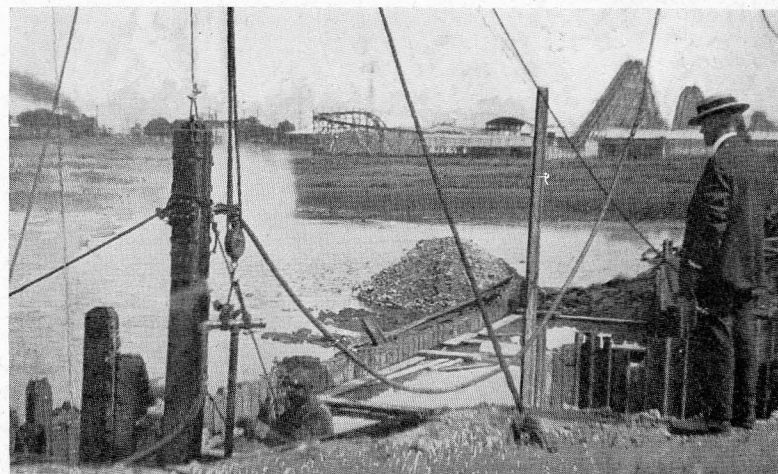
The steam on top of the ram in a double-acting hammer does not add any weight or mass to the ram itself. The pressure of the steam does no more than

increase the velocity of the ram, and this enables more strokes to be delivered in a given time; but each individual stroke or blow must have that necessary surplus energy which drives the pile. A light ram having high velocity will disintegrate the head of the pile, but will never deliver the blow to its lower end.

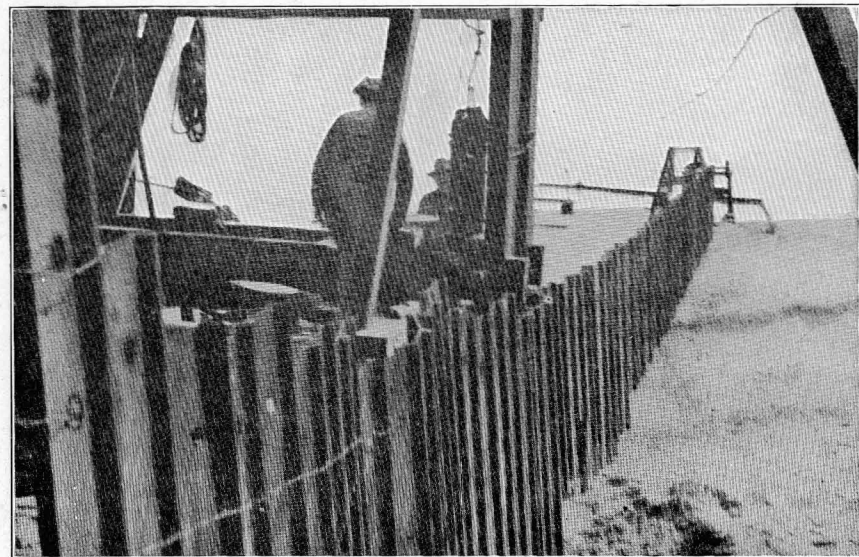
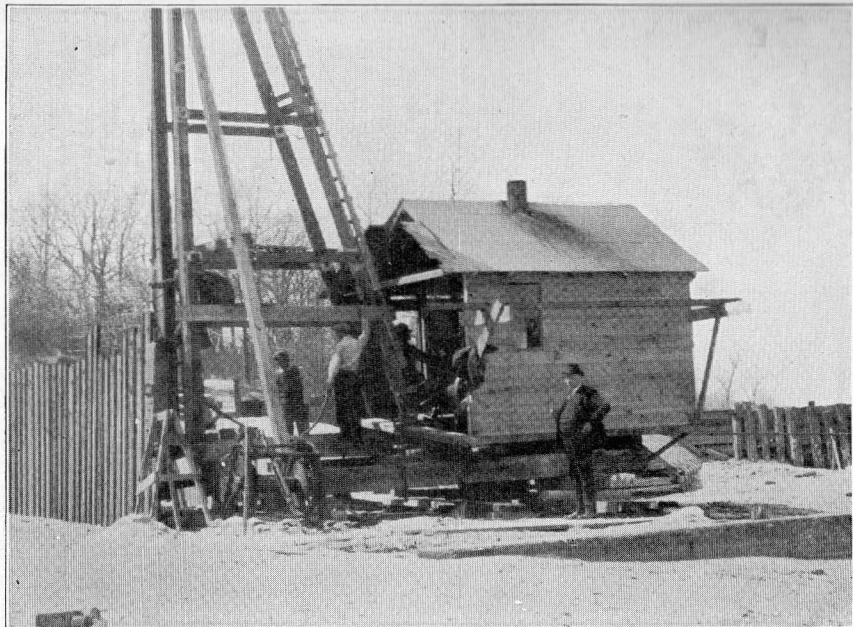
Increase in weight of the ram results in increased efficiency of the blow. Increase of velocity results in decreased efficiency of the blow. It is, therefore, imperative that, in order to obtain the best efficiency, the ram be as heavy as possible, and its velocity held within certain limits.

The California double-acting hammer has no higher velocity at impact than has the Warrington-Vulcan single-acting hammer, and the weight of the ram is a large proportion of its entire weight; in fact, a comparison with other makes of hammers will show that, for the same foot pounds of energy, the ram in the California hammer is about fifty percent heavier than the others.

No double-acting steam hammer can possibly exert a greater number of foot pounds of energy than can be derived by multiplying the total weight of the hammer by the stroke of the ram in feet; this is for the reason that, when this maximum energy is reached, the entire hammer would be lifted by the steam above the ram, at the time of impact, and would bounce up from the pile. As this result is not desirable, and other desired conditions must obtain, it is believed by the Vulcan Iron Works that the energy of a double-acting steam hammer should never be rated above an amount equal to about 75% of this maximum energy, and in the tables showing capacities of the California hammer, this reduced energy is given. The capacities shown are safe and conservative, and can be relied upon.



DRIVING WOOD SHEETING. Size "G" California Hammer, used by Subway Engineering Company at Wolf Lake Bridge, Hammond, Indiana, driving patented interlocking wood sheet piling through 6 feet of old fill, consisting mostly of broken slag and concrete.

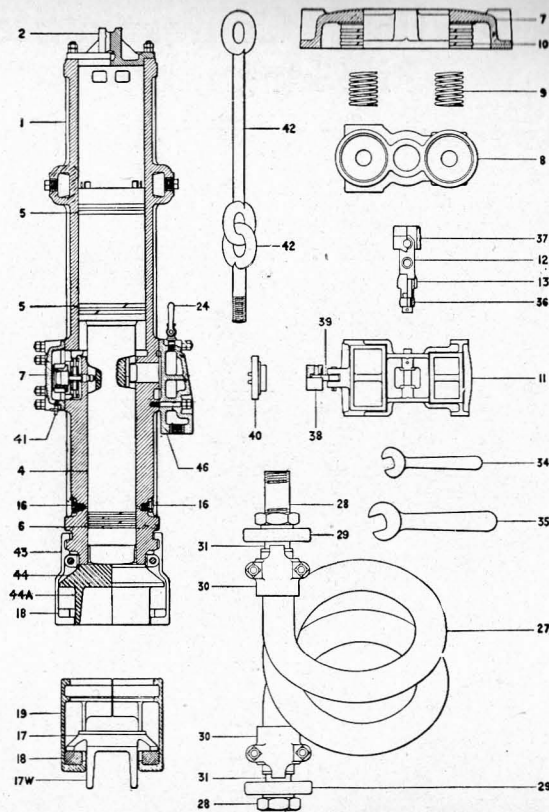


Specifications: California Steam Pile Hammers

No. E	Size of Hammer No. F	No. G
	Distance Between Jaws—Inches	
18	16	..
	Width of Jaws—Inches	
6 $\frac{1}{4}$	5 $\frac{1}{4}$..
	Length of Hammer—Inches	
93	71	47
	Domestic Shipping Weight—Pounds	
4000	1950	925
	Net Weight—Pounds (Not including throttle, hose and pipe)	
3800	1800	750
	Bores of Cylinder—Inches	
10 $\frac{1}{2}$ —7 $\frac{5}{8}$	6 $\frac{15}{16}$ —5 $\frac{5}{16}$	4 $\frac{11}{16}$ —3 $\frac{3}{4}$
	Weight of Ram—Pounds	
950	330	100
	Normal Stroke of Ram—Inches	
16	12	8
	Foot Pounds of Energy per Blow (See page 25)	
3800	1300	375
	Blows per Minute	
150	190	270
	Diameter of Opening for Wooden Pile—Inches	
12 $\frac{1}{4}$	9 $\frac{1}{4}$..
	Width of Bottom Recess for Sheeting—Inches	
8 $\frac{1}{4}$	6 $\frac{1}{4}$	4 $\frac{1}{8}$
	Size of Hose—Inches	
2	1 $\frac{1}{2}$	1
	Standard Length of Hose	
40	35	25
	Boiler Horsepower Required	
25	15	7
	Compressed Air Required (Cubic Feet of Free Air per Minute, no allowance for losses)	
460	167	65
	Capacity for Round Wood Piling—Inches	
12	8	..
	Capacity for Wood Sheeting—Inches	
8 x 12	6 x 10	4 x 8
	Capacity for Steel Sheeting—Inches	
14	12	9

THE ABOVE TABLE IS BASED UPON 85 POUNDS PRESSURE OF STEAM OR AIR AT THE HAMMER

DRIVING STEEL SHEETING. Size "G" California Steam Pile Hammer driving 9 $\frac{1}{4}$ in. steel sheeting through sand, gravel and clay on the beach of Lake Michigan. Taylor Bros. Co., Marine Contractors, of Hubbard Woods, Illinois, drove two piles at one time on these operations.

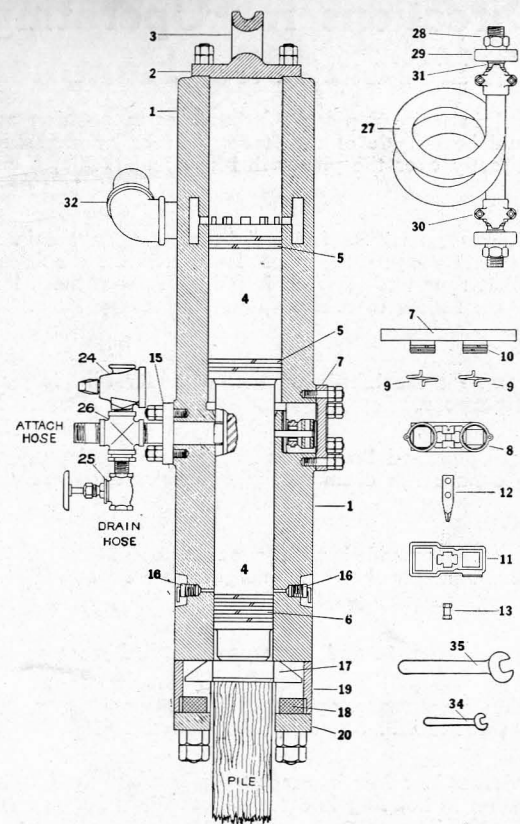


Duplicate Parts for "F" and "E" Hammers

When ordering parts from this list, be sure to state the SIZE OF HAMMER, and ALWAYS GIVE SERIAL NUMBER. This information is cast on the front side of the body.

- | | |
|--|---|
| 1. Body, Studs and Nuts. | 24. Lubricator Filler. |
| 2. Cylinder Head. | 27. Steam Hose. |
| 4. Piston or Ram. | 28. Steam Hose Spud and Nipple. |
| 5. Large Upper Piston Rings. | 29. Steam Hose Nut. |
| 6. Small Lower Piston Rings. | 30. Steam Hose Clamp. |
| 7. Steam Chest Cover. | 31. Steam Hose Stem. |
| 8. Floating Valve Seat. | 34. Small Wrench. |
| 9. Floating Valve Springs. | 35. Large Wrench. |
| 10. Rings for Steam Chest Cover. | *36. Valve Lever Roller. |
| 11. Valve and Pins. | 37. Valve Lever Fulcrum. |
| 12. Valve Lever. | *38. Dashpot Plunger. |
| *13. Valve Lever Shoe. | *39. Dashpot Link. |
| 16. Drain Cocks. | *40. Dashpot Bonnet. |
| 17. Plain Impact Plate for Sheet Pile. | 41. Drain Cocks. |
| 18. Rubber Bumper. | 42. Eye Bolt. |
| 19. Plate Retainer for Sheet Pile. | 43. Plate Retainer for Round Piles. |
| 21. Throttle Valve. | 44. Plain Impact Plate for Round Piles. |
| | 46. Steam Inlet. |

*Items marked * are used on "E" size only.



Duplicate Parts for "G" Hammer

When ordering parts from this list, state the SIZE OF HAMMER, and ALWAYS GIVE SERIAL NUMBER. This information is cast on the front side of the body.

- | | |
|----------------------------------|---------------------------------|
| 1. Body, Studs and Nuts. | 18. Rubber Bumper. |
| 2. Cylinder Head. | 19. Plate Retainer. |
| 4. Piston or Ram. | 20. Cover Plate. |
| 5. Large Upper Piston Rings. | 21. Throttle Valve. |
| 6. Small Lower Piston Rings. | 24. Lubricator. |
| 7. Steam Chest Cover. | 25. Drain Valve. |
| 8. Floating Valve Seat and Pin. | 26. Steam Pipe (4 pieces). |
| 9. Floating Valve Springs. | 27. Steam Hose. |
| 10. Rings for Steam Chest Cover. | 28. Steam Hose Spud and Nipple. |
| 11. Valve. | 29. Steam Hose Nut. |
| 12. Valve Lever. | 30. Steam Hose Clamps. |
| 13. Valve Lever Pin and Blocks. | 31. Steam Hose Stem. |
| 14. Guide Block. | 32. Exhaust Pipe (3 pieces). |
| 16. Drain Cocks. | 34. Small Wrench. |
| 17. Plain Impact Plate. | 35. Large Wrench. |

Directions for Operating California Pile Hammer

1. If to be used in leaders, place the hammer in position and attach hoisting line. The hose should be outside of the leaders. If to be used without leaders, suspend the hammer directly over the pile with block and tackle; a chain block will not lower fast enough.
2. Lower the hammer until its full weight rests upon the impact plate, and the impact plate rests squarely upon the pile. If in leaders, the hammer line must be entirely slack from that time until driving is finished. If without leaders, be sure that the hammer can always follow to this position after every blow. Do not hammer on the rubber bumpers.
3. If using steam, fill the lubricator with cylinder oil. If employing air, use a grade of oil for that purpose.
4. Blow out both pipe and hose before connecting to hammer. Arrange a valve at end of pipe line so hose can drain and pipe be blown out before each subsequent operation.
5. When hammer is provided with a separate lubricator, turn the handle to feed the oil. When hammer has an integral lubricator, the feeding of oil is automatic.
6. Open drain cocks No. 16 and leave open until dry steam issues.
7. Open throttle. If necessary, open and close several times until hammer warms up. Partly closing throttle will reduce pressure and soften the blow.
8. As the pile descends, allow hammer to follow. If used without leaders, maintain just enough tension in hoisting line to keep the hammer upright.
9. If hammer is equipped with a relief throttle valve, when shutting down, move handle all the way to permit trapped steam to escape through cylinder relief.
10. During COLD WEATHER, when not in use, be careful to DRAIN WATER from lubricator and cylinder to OBVIATE DAMAGE from freezing.

Impact Plates

The size "G" California hammer is intended for use only on sheet piling. When shipping this machine we include the Plain Impact Plate No. 17 shown on page 29. This is the general purpose plate.

The sizes "E" and "F" California hammers are designed for driving wood sheeting and also round wood piles. When shipping these machines we include both Plain Impact Plates Nos. 17 and 44 and also the Plate Retainers Nos. 19 and 43. These are the general purpose fittings.

Special shapes of impact plates can be furnished when circumstances require them. For example, when there is to be driven a great amount of wood sheeting, much thinner than the "width of bottom recess" on page 27, or a large quantity of steel sheeting. For either operation there should be employed an impact plate having integral skirts to fit over the pile and centralize the hammer.

Give full information with inquiries.

Vulcan Drop Hammers



Weights of stock sizes of Vulcan Drop Hammers and Dimensions of their standard jaws are as follows:

Weight of Drop Hammer Pounds	Distance Between Jaws Inches	Width of Jaws Inches
500	13	4¼
600	13	4¼
700	14	4¼
800	14	4¼
1,000	16	5¼
1,200	16	5¼
1,500	18	6¼
1,800	18	6¼
2,000	19	7¼
2,500	19	7¼
3,000	20	8¼

All drop hammers are provided with integrally cast hooks for attachment of the rope sling of a pile cap or sheeting cap.

Round pins are used for engine driving. Triangular dies or rolling dies are used for nipper driving. Inquiries or orders must specify which style is required.

These Drop Hammers may be operated either by a hoisting engine or by horsepower. The former method will, of course, give greater speed of operation but where a hoisting engine is not available good work can be done by using one or more draft animals as the motive power.

With engine operation the line is led directly to the hoisting drum, to which it is made fast. The drum friction is engaged to hoist and is released when the hammer reaches the desired height, allowing the drum to spin backwards and the hammer to fall, the operator engaging the friction again just at the moment the hammer strikes the pile. A turned steel pin to which the hoisting line is attached is provided with hammers designed for use with hoisting engine.

When hammer is to be operated by horses, or other draft animals, triangular or rolling dies are substituted for the steel pin referred to above. These are automatically engaged by a pair of nippers, to the bail of which the hoisting line is fastened. On raising the hammer to the required height the arms of the nippers are closed by coming in contact with wedges or an adjustable trip, attached to the upper part of the leaders (see cut on page 49), this releasing the hoisting line from the hammer and permitting the latter to fall. The nippers are then lowered to engage the hammer die for another operation.

These Vulcan Drop Hammers are designed in the light of many years' experience and attention is called to the following features:

First—We aim to get as much weight as possible in the bottom of the hammer.