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(3) Initials of the Referencer

MADRAS RECORD OFFICE.

Government of Madras.

Public works DEPARTMENT.

G.O. No. 3400	Press ~~Mis.~~
445-46	
Dated 22. 10	18/eq.

Not to be folded or roughly handled

*Proceedings of the Madras Government, Public Works Department,
22nd October 1869.*

No. 445. Read the following letter from the Officiating Inspector-General of Irrigation to the Government of India, Public Works Department, (Irrigation,) to the Secretary to Government of Madras, Public Works Department, dated Simla, 14th September 1869, No. 322-I:—

I AM directed to forward herewith, for information, copy of a report, with drawing, on the working of a tool designed by Mr. Fouracres, Executive Engineer of the Workshop Division in the Soane Circle, Bengal, for sinking masonry blocks or wells for foundations of dams and bridges.

2. The contrivance seems ingenious, and it is suggested that the report and drawing should be circulated among the officers of the department.

From the Executive Engineer, Dehree Division, to the Superintending Engineer, Soane Circle, dated Dehree, 9th July 1869, No. 1,131.

I HAVE the honour to comply with your request that I would condense into one my two reports of the 21st and 26th June, on the experiments made in block-sinking with Fouracres' Well Excavator, with a view to publication by the Government of Bengal.

The accompanying drawing will make the construction and action of the excavator clear with very few words of explanation; it consists of:—

1st,—A spear of 1 inch square iron, 12 feet long, with shackle at the top to sling it by, and a cross-head at bottom.

2nd,—Two segmental scoops, hinged on the ends of the cross-head, and forming when closed (the edge of one slipping just within the other) a bucket of rather more than the third of a cylinder. Materials sheet-iron and angle-iron for corners.

3rd,—Two iron collars sliding loosely on the spear, and connected, at a fixed distance asunder, by a second side spear. To the lower collar are attached two hinged rods to open and shut the scoops. To the upper collar a small wooden platform is fixed, on which two men can stand whose weight will force down the instrument, or, in working below water, an iron weight can be substituted.

4th,—A lever hinged on the top of the spear to open the jaws of the scoop when over the discharge platform.

5th,—There are also two stops on the spear, and a spring clasp to keep the jaws open while the scoop is being lowered.

The action is very simple. The machine is slung over the well or block by tackle and pulleys' worked by a windlass from any convenient form of staging; it is lowered, with the jaws in the open position, till it rests on the bottom; the two attendants step on the platform, and one with his foot releases the spring clasp; the windlass men at once wind up, but the weight of the men keeps the scoop from rising till the jaws have closed and it is full of sand; then all rise together; the two men step off on the sides of the well, and, as the full bucket rises to the level, they sway it over a wooden platform at the side, and pull smartly at the lever; the jaws open, and the catch holds them; so the sand falls out on the platform; the machine swings back, and is immediately lowered again, while the sand is shovelled or run away. This can be repeated at the rate of one lift per minute, lifting $1\frac{1}{2}$ to $1\frac{1}{2}$ cubic feet each time.

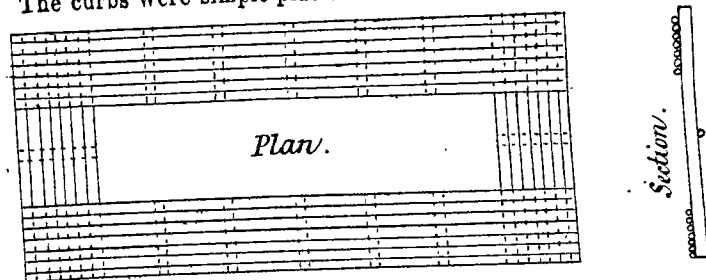
Before proceeding to describe the actual experiments, I will state, as you desired, the nature of the well sunk, and of the curbs used, as the latter are believed to be new, have been found sufficient for the purpose, and are very economical.

The wells were not round wells but rectangular blocks: one was $10\frac{1}{2}$ feet by 6 feet externally, with 18 inches walls; the other, $10\frac{1}{2}$ feet by 5 feet, with 15 inches walls, built of random rubble

*Proceedings of the Madras Government, Public Works Department,
22nd October 1869.*

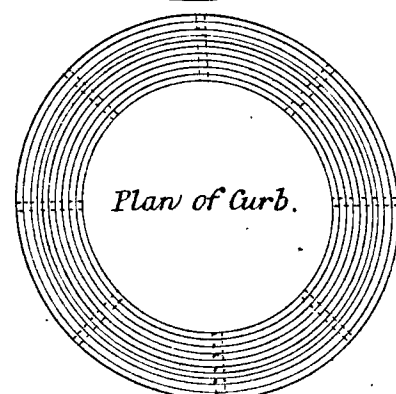
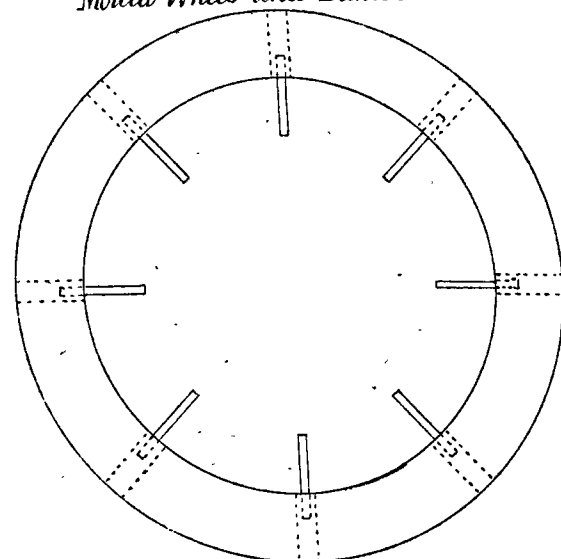
stone in mortar of soorkee and kunkur lime, not plastered, but rough outside; they had been built about a fortnight before they were sunk.

The curbs were simple platforms of small solid hill bamboos, laid close side by side, well lashed at the corners, and with under cleats of short lengths lashed on for strengthening. All crevices to be stuffed with grass, and care to be taken that no bamboos project beyond the masonry.

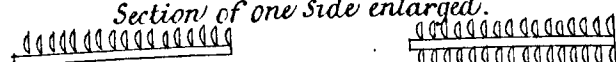


The first course should be through stones, though that was neglected on this occasion.

Mould Wheel and Bamboos.



Section of one side enlarged.



The cost of these curbs is about as follows:—

1. Oblong block, 10 1/2 by 6 feet, 18 inches walls—

	RS.	A.	P.
Forty bamboos, small	0	5	0
String	0	2	0
Labour	0	2	0
	0	9	0

2. Circular wells 5 feet inside, 6 1/2 out—

	RS.	A.	P.
Twenty bamboos	0	2	6
String	0	2	0
Labour	0	2	0
	0	6	6

When round wells are to be sunk, the bamboo curb is thus made. A mould wheel of timber about 9 inches by 4 inches is prepared, whose inside diameter is outside diameter of curb; holes are pierced through this to receive short pieces of solid hill bamboos, projecting inward by the breadth of the curb; these are wedged in; similar bamboos, split in two, are now coiled round and round (the mould wheel being supported 2 feet above the ground) and lashed to the bamboos till the required breadth is attained, when the whole is sawn out. If greater stiffness is needed, bamboos can be coiled both above and below the cleats, in fact a wedge-shaped curb could be made. But the single bamboo has been found sufficient to sink wells 6 feet in sand without cracking.

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I have now to describe the actual trial of the instrument, the difficulties found on the first occasion, and how they were overcome on the second.

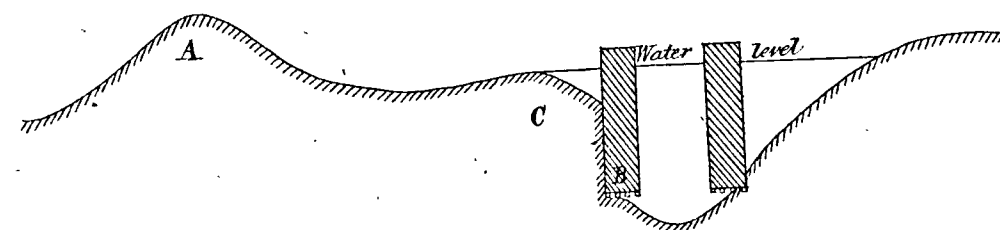
The first block sunk on June 16th was 10 1/2 feet by 6 feet, 18 inches walls, height 6 feet. The instrument worked satisfactorily, bringing up good loads, but rather slowly, one load in a minute and-a-half being the quickest time; the men were quite new to the work, and the disengaging spring had not at this time been added. In the first three and three quarters hours the block sunk 2 feet, showing 130 feet actual excavation, besides what might have blown in below.

On this occasion no platform was provided to receive the sand which was merely discharged from the jaws of the excavator over the side of the well. The effect of the heavy weight of sand continually thudding down some feet on the sand beneath, which was barely above water level in the river, was to make a quicksand of it; and it became evident that the sand was blowing in below. In the second three hours the progress was only one foot.

A man was then set to shovel away the sand as it fell. But this did not suffice: the next foot took five-and-a-half hours to sink, and a crater formed round the well. In three hours more the sinking was only 4 inches, and large stones coming up, a diver was sent down, who reported the flat side of the well, not having the strength a round well would have, was broken in.

All this time the tool itself was working as well as at first.

The cross-section of well, &c., at this time was thus: scale 8 feet to an inch:—



It was very clear that the weight of sand at A., and the continual falling of sand on C., had caused the breach at B.

The tool worked as well, and brought up as full loads out of 6 1/2 feet of water, as it had done at first.

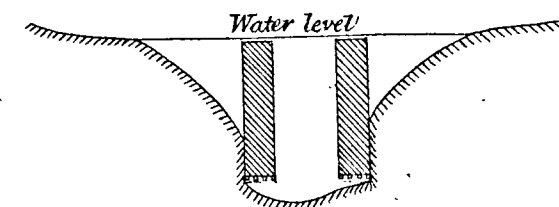
Two beds of pebbles were passed through; the only trouble these caused was, that when one jammed in the jaws of the excavator, part of that load of sand was washed out and lost.

The second experiment on 25th June was with a block 10 1/2 by 5 feet, six feet high, with 15 inches walls. The working gear had been improved, a scaffold to receive the sand added, and the spring disengaging catch added to the excavator, which saved much time in the working.

The loads came up regularly at one per minute on the average, and the sand was deposited in the platform as fast as two men could shovel it away to 15 feet distance.

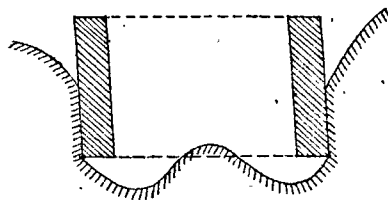
In an hour the block had sunk 9 inches; in two and three quarters hours 2 feet 6 inches nearly; in six hours, 4 feet 11 inches, and in nine hours, 6 feet 3 inches, and the top 3 inches below water level, when work was stopped. Two beds of pebbles, as before, were passed through. No diver at all was employed.

Only a small crater was formed round the well, and the cross-section when completed was thus: scale as before:—



*Proceedings of the Madras Government, Public Works Department,
22nd October 1869.*

The only precaution taken to ensure even sinking was to work the machine chiefly at the two ends, so that the longitudinal section at any time might be thus :—



The block being thus supported at the two ends and in the middle sank steadily without the least crack; occasionally a bite was taken from the middle in passing the machine over.

By the best calculation I could make of sand taken out both by the displacement of the well and from the crater (part of which was before formed by the river current), the sand dredged out was 550 cubic feet; taking average number of lifts at fifty per hour for nine hours, gives 1.22 cubic feet as the average content of a bucket, including the half-empty ones.

Averaging the wages of the nine men employed at 2 Annas 6 Pies, and the time at a day and a half, gives Rupees 2-1-9 as cost of excavation in sinking a well 6 feet deep, or Rupees 3-13-0 per 1,000 feet only.

The men employed were, four at the windlass, two to guide and work the tool, one to shift tackle, two to shovel sand.

To give a general estimate of the cost of a block sunk by this means I think would be rather difficult till we have more experience, but the following may be taken as an approximation.—

Block 10½ feet by 5 feet, walls 1 foot 3 inches, 6 feet high.

	RS.	A.	P.
Masonry 195 cubic feet, say 200 cubic feet, at Rupees 14 per 100 ...	28	0	0
Rupees 2 extra allowed for lead of material in river bed curb, with lead ...	0	10	0
Labour in excavation as above ...	2	1	9
Shifting scaffold and platform from block to block with loss of time ...	1	0	0
Wear and tear of tool and scaffold, &c., say ...	1	0	0
	32	11	9
Contingencies, at ten per cent, say ...	3	4	3
Total ...	36	0	0

This does not include filling the core.

It is a great advantage that divers can be dispensed with, both because the number to be obtained is limited, and because they are very subject to fever in the cold weather. The saving of time is also great.

There appears no reason why this tool should not work in deep water, and, if required, in stiffer soils; by building hold-fasts into the walls of the well as resisting points, and using chain tackling to force the machine down, it would probably act in stiff silt. But, doubtless, in that case a knife-edged curb would be necessary to cut into the soil.

No. 446.

ORDER THEREON, 22nd October 1869, No. 3,460.

IRRIGATION, No. 17.

COMMUNICATED to the Superintend-
ing Engineers.

(True Extract.)

(Signed) H. TULLOCH, Captain, R.E.,

Acting Under Secretary to Government.

To Superintending Engineers
To Major R. B. Kennedy.

Exd. E. C. Shunker.

(339)

GOVERNMENT OF N.-W. PROVINCES.

PUBLIC WORKS DEPARTMENT.

BLOCK-SINKING WITH FOUR ACRES' WELL-EXCAVATOR.

No. 324I., dated Simla, the 14th September, 1869.

From—COL. J. C. ANDERSON, R.E., *Officiating Inspector-General of Irrigation,*

To—THE SECRETARY TO THE GOVERNMENT, *North-Western Provinces, Public Works Dept.*

SIR,—I am directed to forward herewith for information, copy of a report, with drawing, on the working of a tool designed by Mr. Fouracres, Executive Engineer of the Workshop Division in the Sone Circle, Bengal, for sinking masonry blocks or wells for foundations of dams and bridges.

2. The contrivance seems ingenious, and it is suggested that the report and drawing should be circulated among the officers of the department.

No. 1131, dated Dehree, the 9th July, 1869.

From—G. R. LONG, ESQ., *Executive Engineer, Dehree Division,*

To—H. C. LEVINGE, ESQ., *Superintending Engineer, Sone Circle.*

SIR,—I have the honour to comply with your request that I would condense into one my two reports of the 21st and 26th June, on the experiments made in block-sinking with Fouracres' well-excavator, with a view to publication by the Government of Bengal.

The accompanying drawing will make the construction and action of the excavator clear, with very few words of explanation. It consists of—

1st,—A spear of 1-inch square iron, 12 feet long, with shackle at the top to sling it by, and a cross-head at bottom.

2nd,—Two segmental scoops, hinged on the ends of the cross-head, and forming when closed (the edge of one slipping just within the other) a bucket of rather more than the third of a cylinder. Materials—sheet-iron, and angle-iron for corners.

3rd,—Two iron collars, sliding loosely on the spear, and connected, at a fixed distance asunder, by a second side-spear. To the lower collar are attached two hinged rods to open and shut the scoops. To the upper collar a small wooden platform is fixed, on which two men can stand, whose weight will force down the instrument; or, in working below water, an iron weight can be substituted.

4th,—A lever, hinged on the top of the spear, to open the jaws of the scoop when over the discharge-platform.

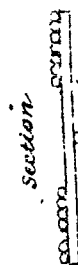
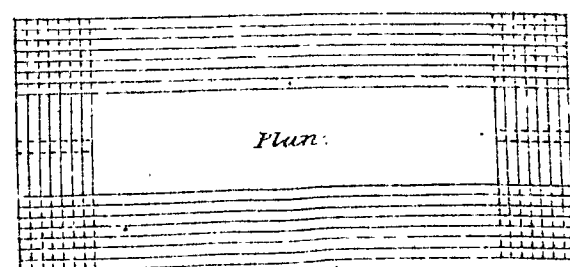
5th,—There are also two stops on the spear, and a spring clasp to keep the jaws open while the scoop is being lowered.

The action is very simple. The machine is slung over the well or block by tackle and pulleys; worked by a windlass from any convenient form of staging; it is lowered, with the jaws in the open position, till it rests on the bottom; the two attendants step on the platform, and one with his foot releases the spring clasp; the windlass-men at once wind up, but the weight of the men keeps the scoop from rising till the jaws have closed, and it is full of sand; then all rise together; the two men step off on the sides of the well, and, as the full bucket rises to the level, they sway it over a wooden platform at the side, and pull smartly at the lever; the jaws open, and the catch holds them; so the sand falls out on the platform; the machine swings back, and is immediately lowered again, while the sand is shovelled or run away. This can be repeated at the rate of one lift per minute, lifting 1½ to 1½ cubic feet each time.

Before proceeding to describe the actual experiments, I will state, as you desired, the nature of the well sunk and of the curbs used, as the latter are believed to be new, have been found sufficient for the purpose, and are very economical.

The wells were not round wells, but rectangular blocks: one was $10\frac{1}{2}$ feet by 6 feet externally, with 18-inches walls—the other, $10\frac{1}{2}$ feet by 5 feet, with 15-inches walls; built of random rubble-stone, in mortar of soorkee and kunkur-lime, not plastered, but rough outside. They had been built about a fortnight before they were sunk.

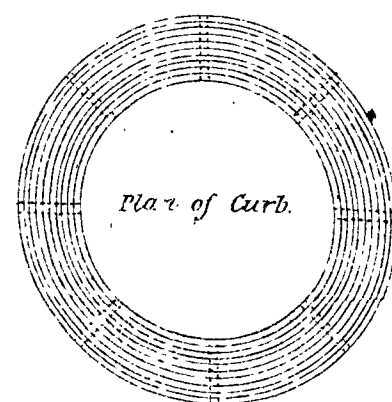
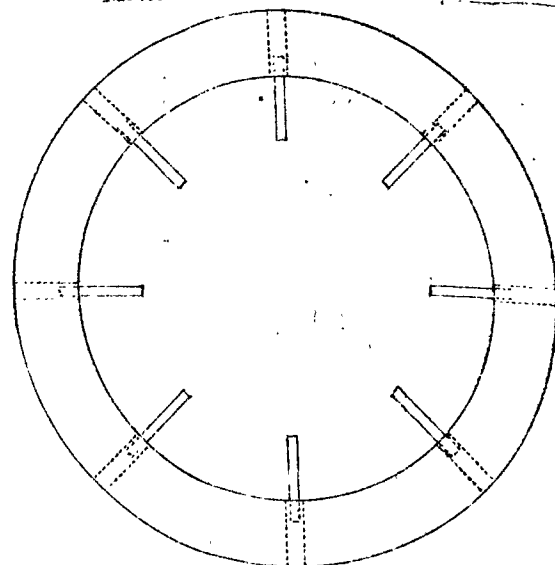
The curbs were simple platforms of small solid hill-bamboos, laid close side by side, well



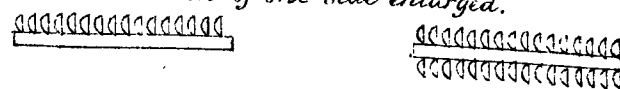
lashed at the corners, and with under-cleats of short lengths lashed on for strengthening. All crevices to be stuffed with grass, and care to be taken that no bamboos project beyond the masonry.

The first course should be through stones, though that was neglected on this occasion.

Mould Wheel and Bamboos.



Section of one side enlarged.



When round wells are to be sunk, the bamboo curb is thus made. A mould-wheel of timber, about 9 inches by 4 inches, is prepared, whose inside diameter is outside diameter of curb; holes are pierced through this to receive short pieces of solid hill-bamboos, projecting inward by the breadth of the curb; these are wedged in; similar bamboos, split in two, are now coiled round and round (the mould-wheel being supported 2 feet above the ground), and lashed to the bamboos till the required breadth is attained, when the whole is sawn out. If greater stiffness is needed, bamboos can be coiled both above and below the cleats; in fact a wedge-shaped curb could be made. But the single bamboo has been found sufficient to sink wells 6 feet in sand without cracking.

The cost of these curbs is about as follows:—

					Rs.	As.	P.
1. Oblong block, $10\frac{1}{2}$ by 6 feet, 18-inches walls—							
40 bamboos, small,	...	...	...	...	0	5	0
String,	...	...	...	...	0	2	0
Labour,	...	...	...	...	0	2	0
					0	9	0
2. Circular wells 5 feet inside, $6\frac{1}{2}$ out—							
20 bamboos,	...	...	...	...	0	2	6
String,	...	...	...	...	0	2	0
Labour,	...	...	...	...	0	2	0
					0	6	6

I have now to describe the actual trial of the instrument, the difficulties found on the first occasion, and how they were overcome on the second.

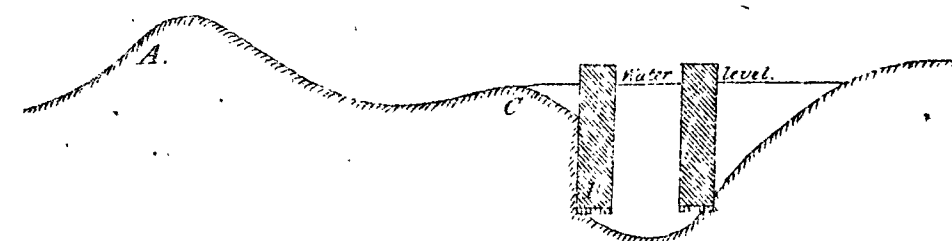
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On this occasion no platform was provided to receive the sand, which was merely discharged from the jaws of the excavator over the side of the well. The effect of the heavy weight of sand continually thudding down some feet on the sand beneath, which was barely above water level in the river, was to make a quicksand of it; and it became evident that the sand was blowing in below. In the second 3 hours the progress was only one foot.

A man was then set to shovel away the sand as it fell. But this did not suffice: the next foot took $5\frac{1}{2}$ hours to sink, and a crater formed round the well. In three hours more, the sinking was only four inches; and large stones coming up, a diver was sent down, who reported the flat side of the well, not having the strength a round well would have, was broken in.

All this time the tool itself was working as well as at first.

The cross-section of the well, &c., at this time was thus—scale 8 feet to an inch:—



It was very clear that the weight of sand at A., and the continual falling of sand on C., had caused the breach at B.

The tool worked as well, and brought up as full loads out of $6\frac{1}{2}$ feet of water, as it had done at first.

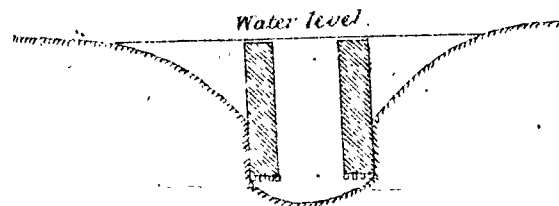
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The second experiment, on 25th June, was with a block $10\frac{1}{2}$ by 5 feet, 6 feet high, with 15-inches walls. The working-gear had been improved; a scaffold to receive the sand added; and the spring disengaging-catch added to the excavator, which saved much time in the working.

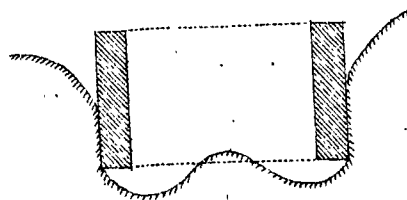
The loads came up regularly at one per minute on the average, and the sand was deposited in the platform as fast as two men could shovel it away to 15 feet distance.

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Averaging the wages of the nine men employed at 2 annas 6 pies, and the time at a day and a half, gives Rs. 2-1-9 as cost of excavation in sinking a well 6 feet deep, or Rs. 3-13-0 per 1,000 feet only.

The men employed were—four at the windlass, two to guide and work the tool, one to shift tackle, two to shovel sand.

To give a general estimate of the cost of a block sunk by this means I think would be rather difficult till we have more experience, but the following may be taken as an approximation:—

Block 10½ feet by 5 feet, walls 1 foot 3 inches, 6 feet high.	Rs.	As.	P.
Masonry 195 cubic feet, say 200 cubic feet, at Rs. 14 per 100,...	23	0	0
Rs. 2 extra allowed for lead of material in river-bed curb, with lead, ...	0	10	0
Labour in excavation, as above, ...	2	1	9
Shifting scaffold and platform from block to block, with loss of time, ...	1	0	0
Wear and tear of tool and scaffold, &c., say, ...	1	0	0
	32	11	9
Contingencies, at 10 per cent., say, ...	3	4	3
Total, ...	Rs. 36	0	0

This does not include filling the core.

It is a great advantage that divers can be dispensed with, both because the number to be obtained is limited, and because they are very subject to fever in the cold weather. The saving of time is also great.

There appears no reason why this tool should not work in deep water, and, if required, in stiffer soils. By building hold-fasts into the walls of the well as resisting points, and using chain tackling to force the machine down, it would probably act in stiff silt; but, doubtless, in that case a knife-edged curb would be necessary to cut into the soil.

150 copies of the plan
connected with Govt. 84,80 were
distributed as follows:—

the Capt. Eng. 1st Bn. —	16
" — 2nd —	17
" — 3rd —	17
" — 4th —	26
" — 5th —	11
" — 6th —	13
" — 7th —	19
" — 8th —	11
" Major Kennedy —	4
" In store —	16

Total — 150

Recd 10/11/69—

It is requested that the
reply to this letter be ad-
dressed to the Secretary to
the Government of India,
in the P. W. Department.

No. 322 J

GOVERNMENT OF INDIA.
PUBLIC WORKS DEPARTMENT.

Irrigation.

To The Secretary to the Govt of Madras,
Public Works Department.

Simla 11th September 1869.

Sir.

I am directed to forward here
with for information, copy of a report with drawing
on the working of a tool designed by Mr. Sourav
Executive Engineer of the workshop. Division
in the Poane Circle, Bengal, for sinking masonry
blocks or wells for foundations of dams and
bridges.

2.

The contrivance seems ingenious
and it is suggested that the report and
drawing should be circulated among the Officers
of the Department.

I have the honor to be,
Sir

Your Most Obedt. Servt.
J. A. M. J. Col. R. E.
Offg. Inspector Genl. of Irrigation.

[Faint, illegible handwriting]

Mr. 1859. 24th.
24th 24059

Spain
The north of India
1859.

1859. 24th.
24th 24059

1859. 24th.
24th 24059

Documentary
with a drawing, the
copy of a report in
a book designed for
publishing missionary
bulletins or news for
promotions of ideas
and kindred.

1859. 24th 24059

1859. 24th 24059

WPK
3400
1859

Communicated to the
Superintendent Engineers

1859. 24th.
24th 24059

[Signature]

1859. 24th 24059

1859. 24th 24059

C. 6000/14000

With an Order

to the Engineer in Charge

22/10/18

foundations of dams and bridges

Cue 4059
Govt. of 1869 Madras.

PUBLIC WORKS.

To The Superintending Engineer

Dated

&c., &c., &c.

Recd.

Entd

G. O. 22^d Octr 1869, No. 36,00

Nos. 445 & 446

Tool called from the list of tools
forwarding, with a drawing,
a copy of a report on the utility
of a tool designed for sinking
masonry blocks or wells for
foundations of dams & bridges.
Cud Wm D. J. concerned

ALL

sent to the