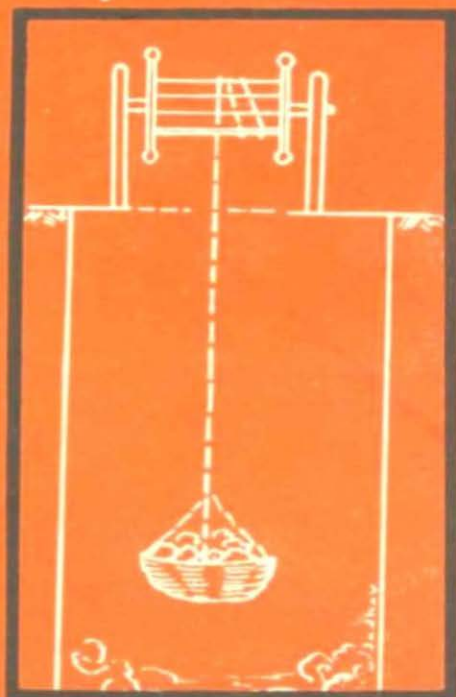




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# Debris REMOVING DEVICES IN COMMON USE



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**DEBRIS REMOVING DEVICES  
IN COMMON USE IN MAHARASHTRA STATE**

**DEPARTMENT OF AGRICULTURE,  
MAHARASHTRA STATE, POONA.**

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## FOREWORD

Nearly seven percent of the total cropped area in the Maharashtra State is under irrigation as compared to 19 percent for the country as a whole. This shows that there is a great need and scope for increasing the area under irrigation in Maharashtra.

Wells form an important source of irrigation in the State. In order to bring more area under well irrigation, Government has been encouraging the cultivators to dig new wells and deepen the existing ones. One of the important and laborious operations in digging or deepening a well is the removal of debris. The present bulletin prepared by Shri S. S. Vanjari, Agricultural Engineer, Agriculture Department, Maharashtra State, Poona-5 describes some of the devices used for this purpose. It is hoped that this bulletin will be of use to Extension Workers in the State, in guiding the farmers in the selection of an appropriate device, suitable for their purpose.

POONA :  
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POONA-1.

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## **DEBRIS REMOVING DEVICE**

### **Introduction**

Wells play an important role in irrigation in all parts of India especially in Maharashtra. In India one third of the total irrigated area is under well irrigation while in Maharashtra more than 50 per cent of the irrigated area is under well irrigation. On an average, one well can irrigate about 2 to 3 acres.

From the point of view of irrigation development in Maharashtra State, digging of new wells and deepening of existing wells has become one of the most important programmes in the sector of Agriculture. The hard compact basalt rock formation offers several difficulties in this programme. The ground water availability in most parts of the State is below 30 ft. from the surface of the land, for irrigation purposes. Since there is no water table or saturated aquifer as such, whatever water that is flowing through cracks and fissures, has to be stored in the relatively large diameter pit or well. Well diameters vary from 6' to 30' depending upon the ground water condition of the place.

Deepening of wells increases the hydraulic gradient and the yield of well. It is a sure method for alluvial soils. In the region of rocks it offers more chances of tapping additional cracks or fissures. Deepening can be done by digging, boring and blasting. Digging requires no skill but is laborious and costly. Digging is possible up to a maximum depth of 50 feet.

A huge quantity of soil, murum and broken pieces of stones are to be excavated, lifted to the height of about 40 to 50 feet and carried to a distance of about 10 to 20 feet away from the pit. Now-a-days it is very difficult to get required number of labourers at the required time and on economic wages, in several areas for such type of slightly

specialised, laborious and risky job. Poor farmers also take up the work of new wells as a gamble. When he succeeds in striking ample supply of good quality water, he feels himself fortunate and gradually recoups the expenditure incurred on well, otherwise the cost becomes a burden on him.

### Method of digging wells

*Open wells.*—Circular wells are most common but at many places square wells are also constructed with steps to go down to the water level. The surface diameter of the well varies from 6 to 30 feet and it gradually decreases as depth increases. This is necessary for ease in digging and also for checking the top soil layers from sliding. In rocky strata this is not a very important problem but the black soil offers considerable difficulties in this respect. In such cases bamboo matting or branches of trees in the form of ring are fixed to avoid collapse of the side walls.

The excavated material is filled in the baskets or iron ghamelas and carried as head load outside the well area. The operation of carrying the excavated material is done by labourers standing in a queue. Steps are made inside the well for the workers who carry the loaded baskets or ghamelas and pass it on to the next, thereby carrying the material to the top of the well. A bamboo ladder also serves the purpose of these steps. About 3 to 4 persons sit on the alternate steps of the ladder, and the basket is passed on continuously from the bottom to the top of the well. At the ground level a team of 3 to 5 persons is required to carry baskets about 10 to 15 feet distance. At the same time, about 4 to 5 persons are engaged in filling, lifting and carrying baskets to the team of the persons sitting on the ladder. Thus in all 15 to 20 persons are required to complete this cycle. They in turn change their position and thus the work is carried on.

When the depth increases beyond 15 feet, the difficulty becomes acute. At greater depth some mechanical device

(such as a pulley and rope) is used for the purpose of lifting the material.

*Deepening of old wells.*—Most of the old wells do not supply enough water for irrigation. These wells are difficult to deepen due to hard rock strata at the bottom; unless hand made holes and gun powder or drilled holes and gelatine and detonators are used for blasting the hard rock strata. The latter method breaks the stones to the depth of 2 to 2½ feet. About 8 to 15 tons of loose material has to be removed after one blasting which is a troublesome job for the cultivators.

#### **Methods of debris lifting.**

The process of clearing the well involves three main actions namely:—

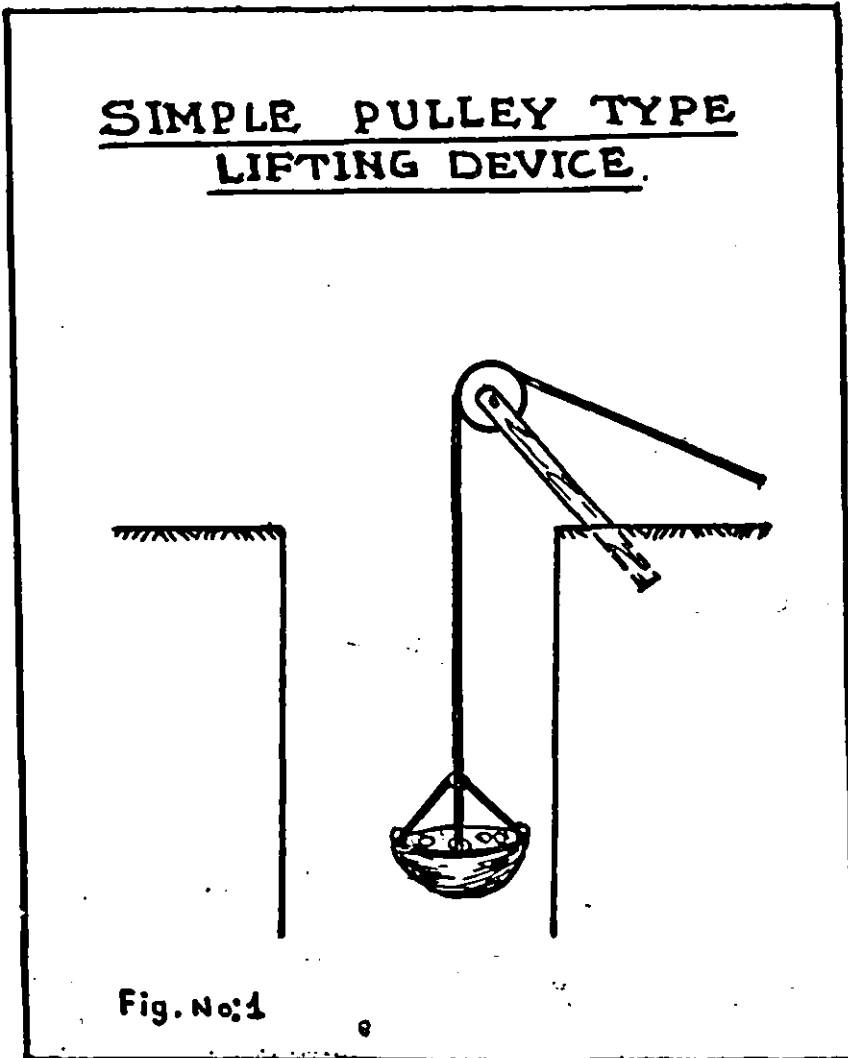
- (1) Collection and filling up of the excavated material in the baskets.
- (2) Lifting the baskets to the top of the well and
- (3) Carrying the baskets to a distance of 10 to 15 feet from the well for dumping the material.

Out of the three actions, action No. 2 is one which requires first attention. This action requires maximum energy. To carry the material away from the well for dumping i. e. action No. 2 is the next in consideration. If problem of action Nos. 2 and 3 is solved then much will be achieved. Action No. 1 can be done mechanically but due to hard, irregular size, shape and nature of the material it is difficult to incorporate the same in the simple device.

Taking into consideration the difficulties involved in the well clearing work, its importance and necessity, some of the farmers have tried to use many devices for this purpose. Most of them fall in one of the following categories.

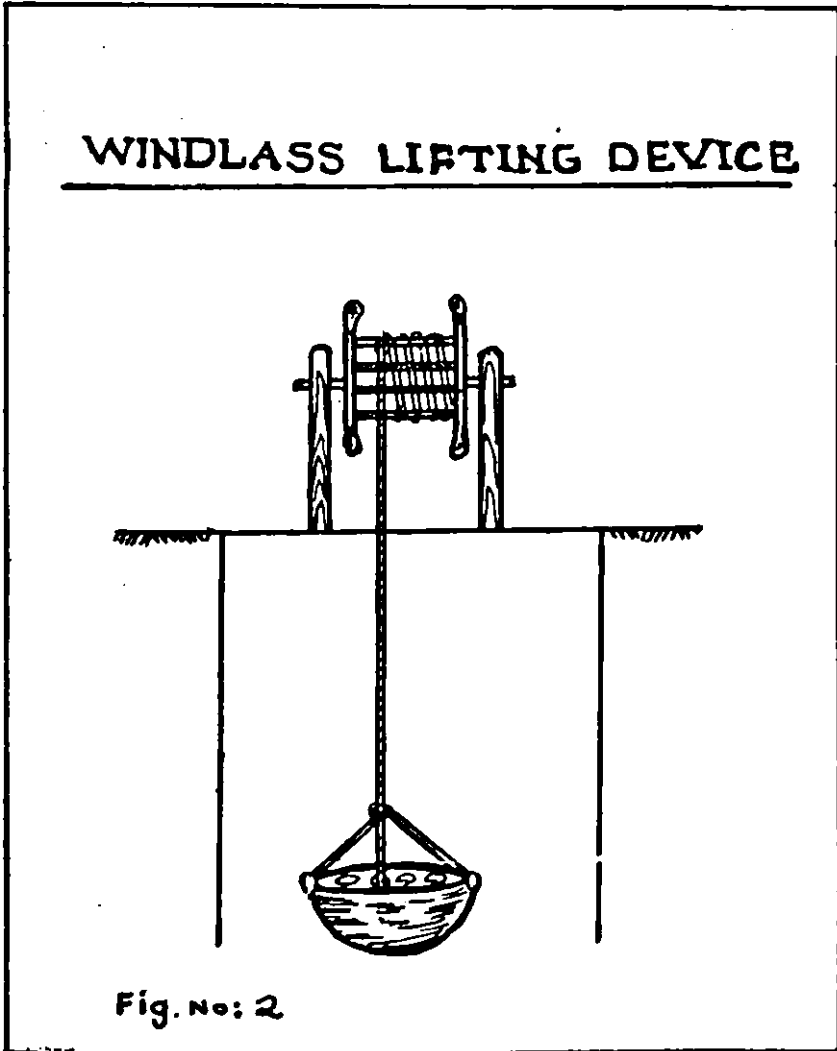


## Simple Pulley Type or Mhot Type



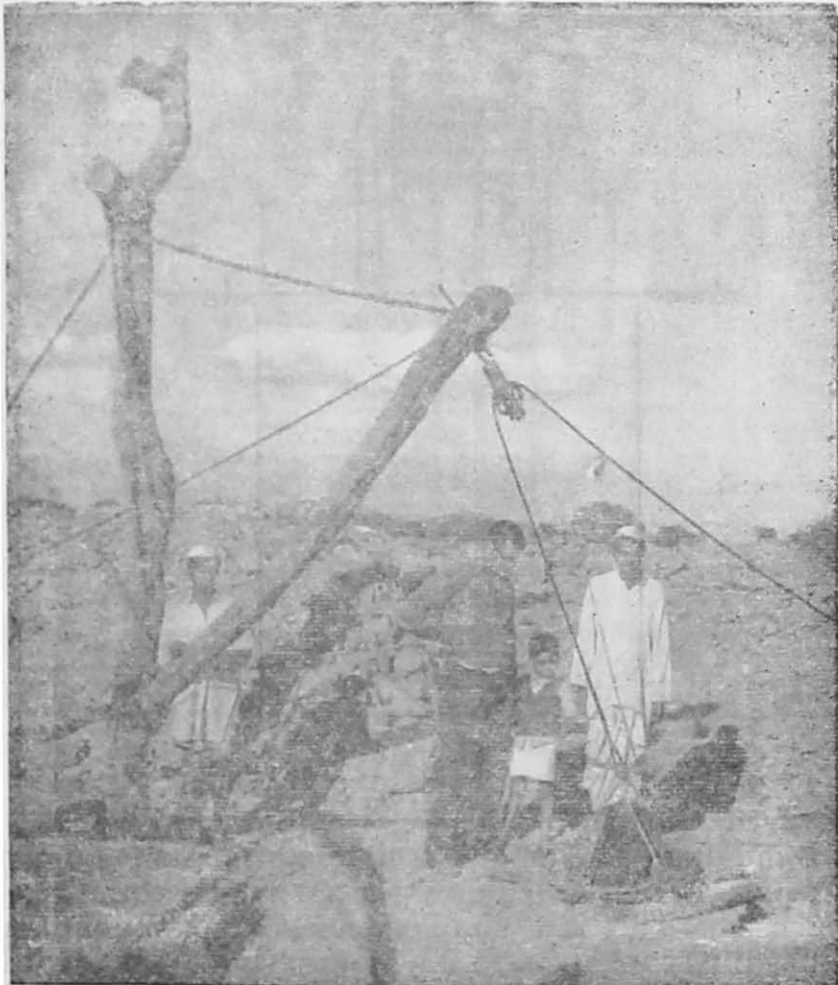
(A) *Mhot type*.—This is a simple arrangement as that of Mhot used for lifting water. Simple arrangement of pulley and rope is made and Mhot is replaced by a bucket. The bucket is to be filled by the labourers at the bottom of the well and is then pulled by a pair of bullocks on an inclined platform. This type of arrangement only carries excavated material to the top. This system offers convenience in lifting but there is no mechanical advantage, the work done

is less due to pulley arrangement but reduces the number of labourers. The action No. 3 referred to above cannot be accomplished simultaneously. This kind of set costs about Rs. 25 to Rs. 30.



(B) *Windlass*.—This is also a simple arrangement. When bullock pair is not to be used the Windlass arrangement can be used. This is a simple device called Rahat especially used in Konkan tract for lifting water. The wooden shaft is provided with wooden handles on it's circumference. This arrangement is fitted in between two supports

at the top of the well. One end of the rope is to be tied to the shaft and to the other end a bucket is tied. By turning the handles in anticlockwise manner the bucket can be lowered in the well. After filling up the bucket by the excavated material, the handles can be turned in clockwise manner by manual labour so that the filled bucket can be lifted to the top of the well. Due to this arrangement a worker gets mechanical advantage thus energy and time, is saved, but the action No. 3 referred to **Country Crane Type Wooden Devices**



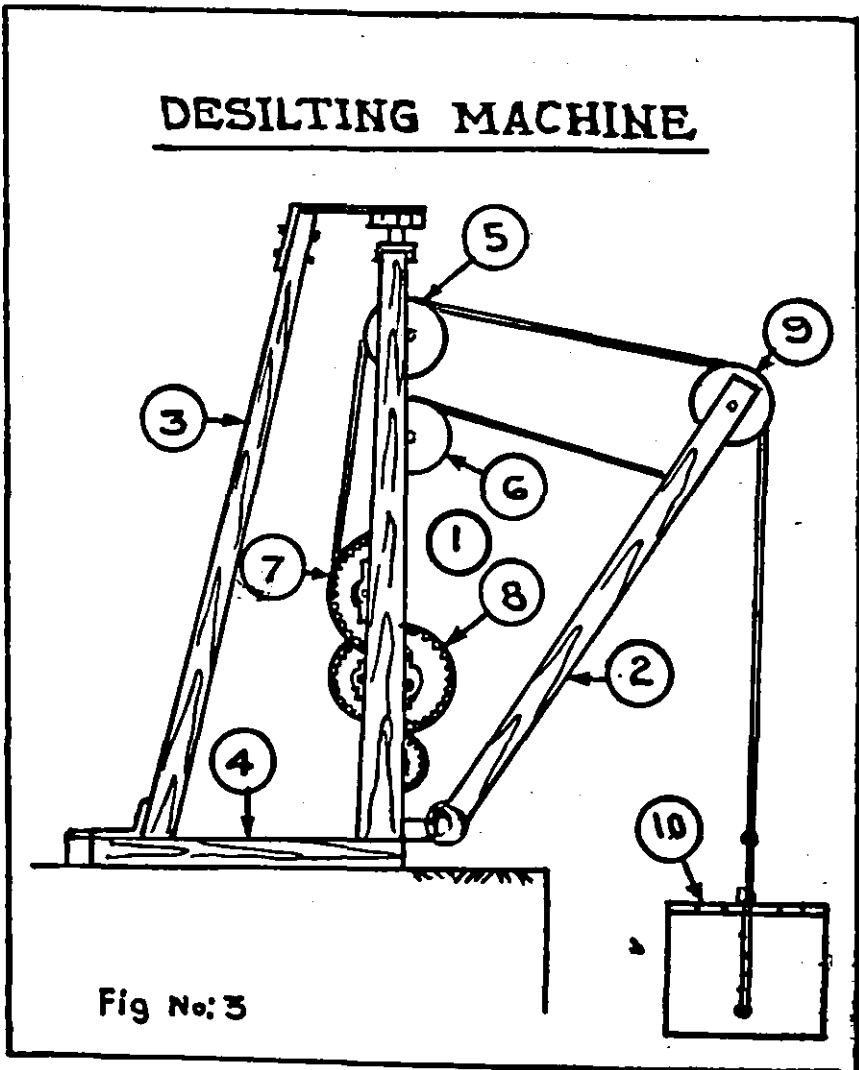
above cannot be accomplished simultaneously. This type of arrangement costs Rs. 50 to Rs. 75.

This is altogether a separate device and is also simple. In order to achieve both the actions i. e. No. 2 and 3, arrangements are made in this device. It consists of a wooden post, about 20 feet high and 1'-0" to 1'-6" in diameter, the top of which is in the shape of Y. This wooden post is fixed near the well. Another wooden post of 8 inches to 10 inches in diameter having Y shape at one end is taken and the Y shape end is held loose at the bottom of vertical wooden post at a distance of 2 to 3 feet from the ground level and is held in inclined position by means of chain i. e. the top of the fixed pole and the Y shaped bottom of the inclined pole are held in equilibrium by tying both the ends with chain. The top of the inclined pole and the fixed pole are also connected by means of a chain so that the inclined pole can be turned in horizontal plane. This arrangement facilitates the action No. 3 i. e. the excavated material can be dumped at a distance of 10 to 15 feet away from the well simultaneously. So as to provide support to the fixed pole, a chain is tied to the top of the fixed pole and other end is tied to a peg which is fixed firmly in the ground. Similarly, the top of the inclined pole is provided with a separate chain of the same diameter; the other end of which is held in position by one person.

To the top of the inclined pole a pulley block is fixed where coir or manila rope or steel wire rope can be passed over the pulley. To one end of the rope is tied a basket and to the other end the yoke. The bullocks can be driven to and fro so as to lift the material from the bottom to the top of the well. On receipt of the material at the top, the person holding the chain, sets it free so that the inclined pole automatically turns sideways speedily. Thus the loaded basket gets the momentum and is thrown out 10 to 15 feet away from the well. The basket is then emptied at the stack. Likewise this operation is to be performed. Thus the material from the bottom of the well can be lifted and transported to the heap simultaneously without there being a need to employ more number of labourers and with less use of energy in comparatively less time.

On this device, material such as horizontal and vertical poles used are from available unfinished tree trunks. The vertical post is not so rigidly fixed up in the ground as such less load can be lifted at one time. Considering local available material, the cost of such type of device comes to Rs. 400 to 500.

### Desilting Machine



*Constructional Details.*—This machine mainly consists of one central wooden post (1) made up of 2 side square poles held together with mild steel rods, tapered to the top and held in position in two bushings, one at the bottom and other at the top with pins welded to mild steel channels, bolted one at either end of the vertical central post. One wooden arm (2) is pinned at one end to the bottom channel of vertical post. The other end is kept in desired position with a rope passing over pulley at (6). The other end of rope is tied to wooden drum on shaft at (8). The position of this wooden arm can be lowered or taken up by a handle and a pair of gear wheels and ratchet and paul on shaft at (8). To the free end of this arm one wooden pulley (9) is kept moving on a shaft passing through two mild steel flats and pole. The mild steel flats are bolted to the arm at this end. The rope from the bucket is taken over the pulley (9). It then passes over the pulley at 5 and taken to the wooden drum on shaft at (7). With a pair of gear wheels on this shaft and a ratchet and paul arrangement the bucket can be lowered or taken up with a handle fixed on this shaft.

Two wooden base members (4) on ground are connected at one end with the help of mild steel flats to each member. Mild steel flat forms a loop in the centre to serve as a bush for the pin welded to the bottom channel of vertical post. This pin swivels in the bush.

Two supporting wooden members (3) are bolted at either end to the wooden members (4). On the other end two mild steel flats are bolted and connected at the end by welding. To this plate one bush is formed by welding. In this bush the pin welded to the top channel of vertical post swivels. Black iron sheet bucket (10) of 2' x 2' x 2' in size having a handle is bolted to the U shape mild steel flat. This mild steel flat is held in position with two pins, one at either end of the bucket welded to it. Two loose mild steel pins are inserted through the hole on the flat on either side and through the hole made in the bucket on either side. When these two pins are taken out, the bucket swivels around the bottom pins and the contents in this

bucket are emptied. Cost of such a device comes to Rs. 1,600 to Rs. 2,000.

*Mode of Operation.*—The whole contrivance is kept 5 to 6 feet away from the well under construction. The arm (2) is lowered with the help of handle and gear arrangements at (8) to the desired position. The bucket (10) is now lowered in the well with the rope, gear and handle arrangement at (7). When material is filled up in the bucket it is taken up with the help of handle at (7) clear from the top. The vertical post (1) held in position in two bushings one at bottom and other at the top is now swiveled to the side taking the arm (2) either on left or right side. By operating handle at (8) this arm is lowered till the bucket touches the ground. The two loose pins in the bucket are removed and the bucket gets tilted and the contents in the bucket are emptied. The arm is again taken up with the help of handle at (8) and the bucket is again lowered in the well with the arrangement of gear and handle at (8). The operation is repeated.

### **Small Cranes mounted on the Truck (Breakdown Van)**

Small mobile cranes are used for shifting breakdown vehicles. Such type of mobile cranes can also be used for removing debris from wells.

*Constructional Details.*—The mobile crane consists of a petrol or diesel van in the body of which lifting contrivance such as steel fabricated arms, pulleys, wire ropes, winch etc. are fitted up. This contrivance requires about 20 to 30 H. P. and has a lifting capacity of about 3000 to 4000 lbs. The cost of the complete machine is about Rs. 30,000 to 40,000.

*Mode of operation.*—The mobile crane is taken to the well. The arm is adjusted to the required distance. The hook to which a bucket can be fixed up is lowered by operating the winch to which the wire rope is wound. When the bucket is filled up, the winch is operated in a reverse direction till the bucket is lifted clear of the ground. The

fabricated arm is then operated over the turn table to the desired position and the bucket is lowered to the ground and the material emptied. The whole cycle is repeated.

## BREAKDOWN VAN

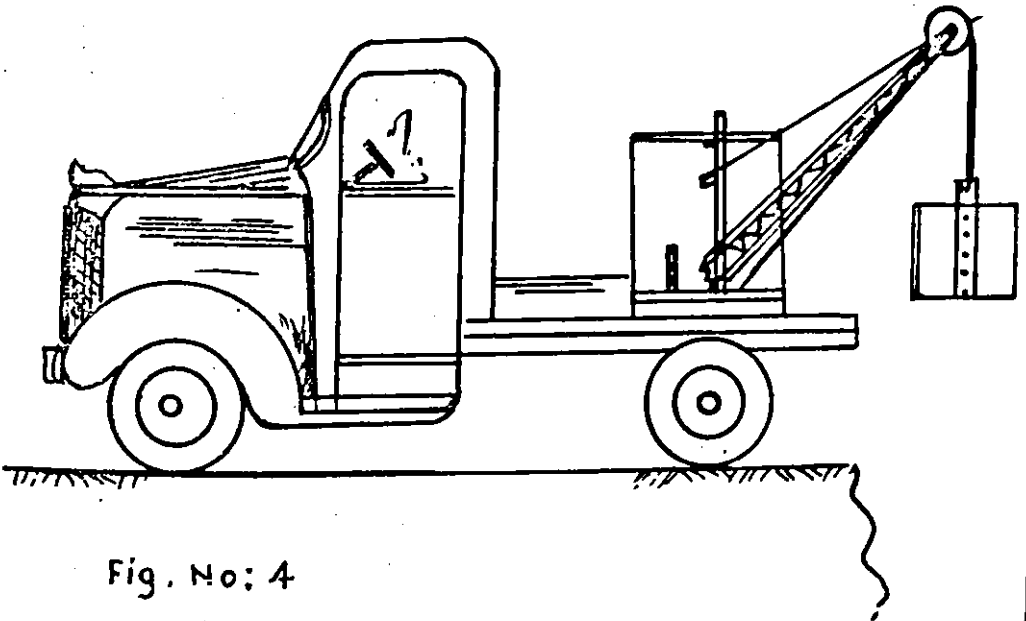


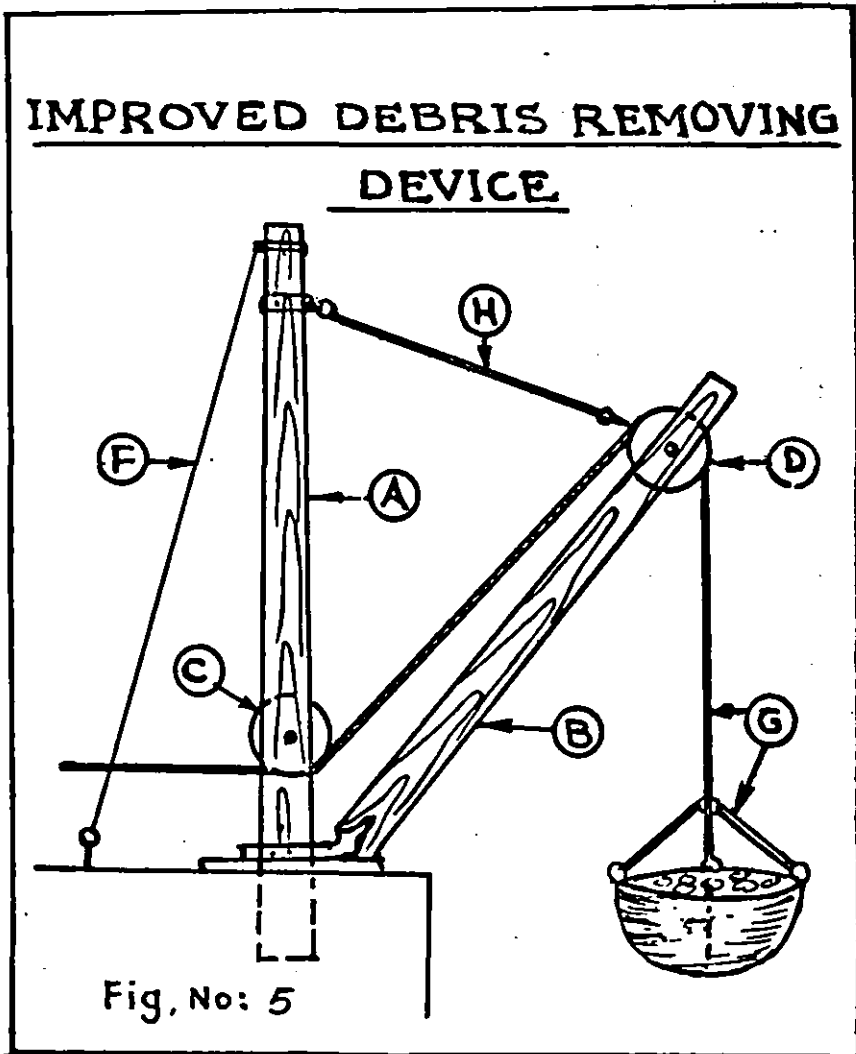
Fig. No: 4

### **Improved Debris removing Device**

The machine consists of a wooden pole (A) which is fixed vertically in cement concrete 5 to 6 feet away from the well. In this pole a 2 inch wide slit is made at a height of 2 feet above the ground level and the pulley (C) is fixed in the slit by means of a steel shaft and end pins. Two wire ropes (F) are tied to the top of this pole (A) to serve as stays. Another wooden pole (B) is taken and the pulley (D) is fixed in a slit made in it near one end. To the other end of pole (B) an angle iron bracket is fixed. The



pole (B) is then kept near the pole (A) in such a way that the angle iron bracket works around the pole (A) at ground level. The other end of the pole (B) is tied to the top of pole (A) by a wire rope (H) through a U clamp. A steel bucket (E) is used for loading debris from well. This bucket (E) is tied to a wire rope (G) which runs over the pulley (D) and under the pulley (C) and is finally pulled by a pair of bullocks on plain ground.



*Mode of Operation.*—After blasting a charge in a well, the bucket is lowered in it. Labourers fill the bucket with the debris. When the bullocks pull the wire rope (G) the bucket is lifted till it reaches the top of the well. A labourer then swings the arm around, till it touches the ground away from the well and the contents of the bucket are emptied there. The arm (B) is again swung back to its former position. The cycle is then repeated. The place where the bucket (E) touches the bottom of the well can be changed to suit the convenience of the labourers merely by changing the inclination of the pole (B) to the horizontal.

The cost of purchasing and installing such a device comes to Rs. 1,000 to Rs. 1,200. Use of this device saves much labour, time and cost as compared to the normal method of removing the debris such as head load. Since the locally available material is not used in the construction of this device and due to high cost it is not advisable for an individual cultivator to purchase this equipment for one or two wells.

The material used for construction of such device consists of vertical and horizontal poles of finished teak wood logs, steel wire rope, wire rope clamps, iron pan, angle iron etc. as such its cost is Rs. 1,200 which is comparatively higher than the cost of country crane, wooden type. However, due to rigidity of fixture of vertical pole in cement concrete, comparatively 4 to 5 times more load can be lifted and brought up. Such type of device was demonstrated on a well, under construction, at Vadala, District Sholapur for removing debris and also worked for removing mud etc. from a well at Agricultural College Dairy Farm Poona. One such device has also been supplied to Gramsevak Training Centre, Jalna for desilting and debris removing purposes.

Looking to the advantage over the local wooden crane and lower cost as compared to breakdown vans, such type of device could be economically used for removing debris from wells, under construction, or desilting purposes.

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