ERECTING

(PART 1)

Serial 2246A Edition 1

ERECTING TOOLS AND APPLIANCES

INTRODUCTION

1. Erecting is the putting together, assembling, or building of a whole from its parts. It refers to any mechanism or apparatus of appreciable size, such as an engine, dynamo, machine, or other mechanical device commonly used in the various engineering industries. It may be said to be divided into two classes: *shop* and *field erecting*.

2. On the completion of the parts of any mechanism, it is customary to assemble these together in the shop where they have been built, in order to test the device as a whole. When such shop tests have been satisfactorily carried out, the mechanism is next usually disassembled into parts or units of convenient size and packed ready for transportation to its destination. This first assembly is called **shop erecting.**

3. After arrival at its destination, the several parts or units are once more assembled or erected as a whole, the mechanism, however, being placed this time in its final working position; it is again tested, and, if the conditions of the contract have been met, is delivered to the purchaser. This second assembly is called **field erecting.**

The parts forming the complete mechanism are sometimes shipped direct to their destination without first being assembled and tested in the shop where built. When this is done, however, it is usually owing to extraordinary conditions, such as lack of time in the fulfilment of a contract, inadequate assembling or testing facilities, too great expense, or to duplicate apparatus having already been built so that there is full assurance that all parts will go together without any preliminary fitting or adjusting.

4. The tools and appliances used in erecting are those employed in bench, vise, and floor work, together with pinch bars, rollers, blocking devices, hoists, trucks, etc.

PINCH BARS, ROLLERS, AND BLOCKING DEVICES

PINCH BARS AND ROLLERS

5. A **pinch bar** is an iron or steel bar used to pry up or move heavy objects. The most common form of pinch bar, Fig. 1 (*a*), is a straight bar, one end of which has a flat, wedge-shaped point turned slightly to one side, and the other end

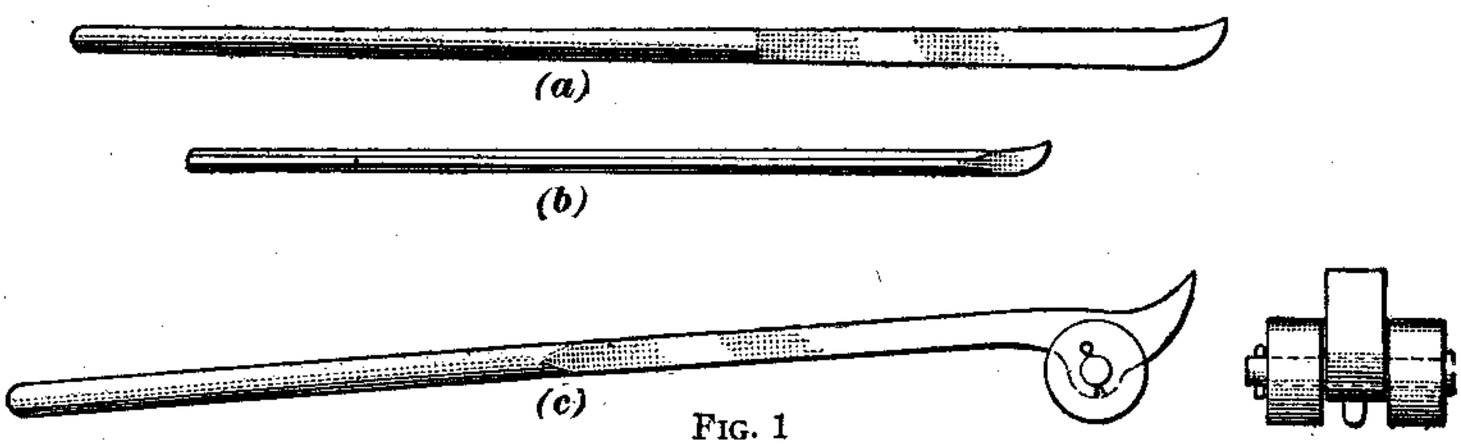

FIG. 1

of which is round and slightly tapering to form a handle. This form of bar is usually about 4 to 6 feet long. The smaller pinch bars are from 2 to 4 feet long, and are made of $\frac{5}{8}$-inch or $\frac{3}{4}$-inch octagonal steel, as shown at (*b*).

A rather convenient form of pinch bar that is well adapted for lifting and moving quite heavy weights is illustrated in Fig. 1 (*c*). The bar is mounted on two wheels, and consequently, when it supports a heavy weight, the bar and weight can be easily shifted.

6. **Rollers** are cylinders, either of wood or metal, and of of apparatus, thus enabling it to be readily moved for short distances. When metal rollers are used and the weight of the apparatus is not too great, they are generally made of pipe, not only because they are lighter and cheaper in cost, but also because they are more easily kept in alinement when in use either by inserting a bar and moving them, or by hitting them with a sledge.

BLOCKS AND TRESTLES

7. Any material or device employed in temporarily supporting work in process of erection, is known as *blocking*. The purpose of such supports is either to aline the work in some particular manner, to raise it into a certain position, or to move it in a given direction so that the assembling or erecting may be the more readily accomplished.

The form of the blocking depends on the class of work on which it is used and the service it is intended to perform. Frequently both the simplest and the most elaborate blocking devices are used advantageously on the same piece of work. Among the simpler forms may be mentioned *wooden blocks*, *iron blocks*, and *trestles*, or *horses*, while the more elaborate forms include various kinds of *screw jacks*, *ratchet jacks*, and *hydraulic jacks*.

8. Wooden Blocks.—Wooden blocks are used to a considerable extent in assembling even the heaviest apparatus, especially in the field where facilities for erecting are, as a rule, not so good as in the shop in which the apparatus is built. The blocks are usually square in cross-section often as large as 14 in. × 14 in. and of length varying from 1 to 6 feet. When blocks of this kind are to be used only once and then discarded, soft wood, such as pine, is generally selected; but if for constant service, hard wood, like oak or hickory, is to be preferred. Sometimes small wooden blocks or wedges are used for leveling apparatus on its foundation before grouting, or cementing, it in position. Hard wood should always be employed for this purpose, and the blocks should be so placed that the grain is

9. Iron Blocks.—Iron blocks are used more frequently in the shop than in the field, as they are more permanent and keep their dimensions better. Their greater weight is not a factor to be considered, since they are not transported great distances as in field erecting. When blocks are piled on top of one another in service, provision is sometimes made against slipping by means of slots or holes in the blocks into which **T** bolts or dowel-pins are inserted to lock adjacent blocks together.

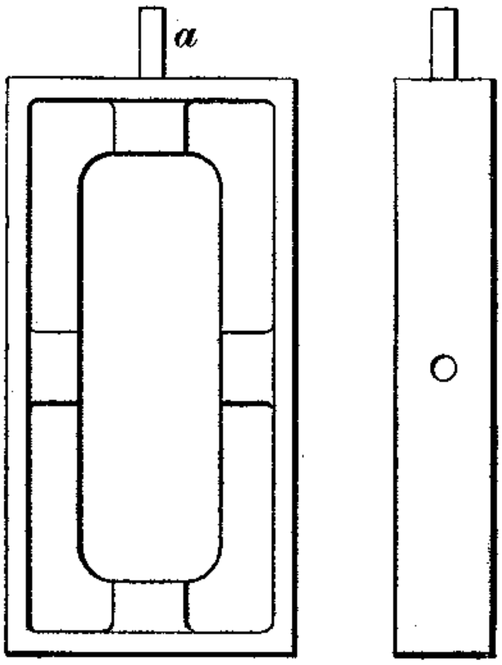

FIG. 2

The simplest and the most common forms of iron blocking are large parallels used in connection with machine tools. Large *parallels*, or *parallel blocks*, as they are often called, are usually made hollow, and are well ribbed in order to safely carry the great weight often placed upon them. *Cylindrical blocks* are also largely used.

10. Two excellent styles of parallel iron blocks are shown in Figs. 2 and 3. The form of the block shown in Fig. 2 combines considerable strength with lightness. It is planed all over so that opposite sides are parallel and adjacent sides are at right

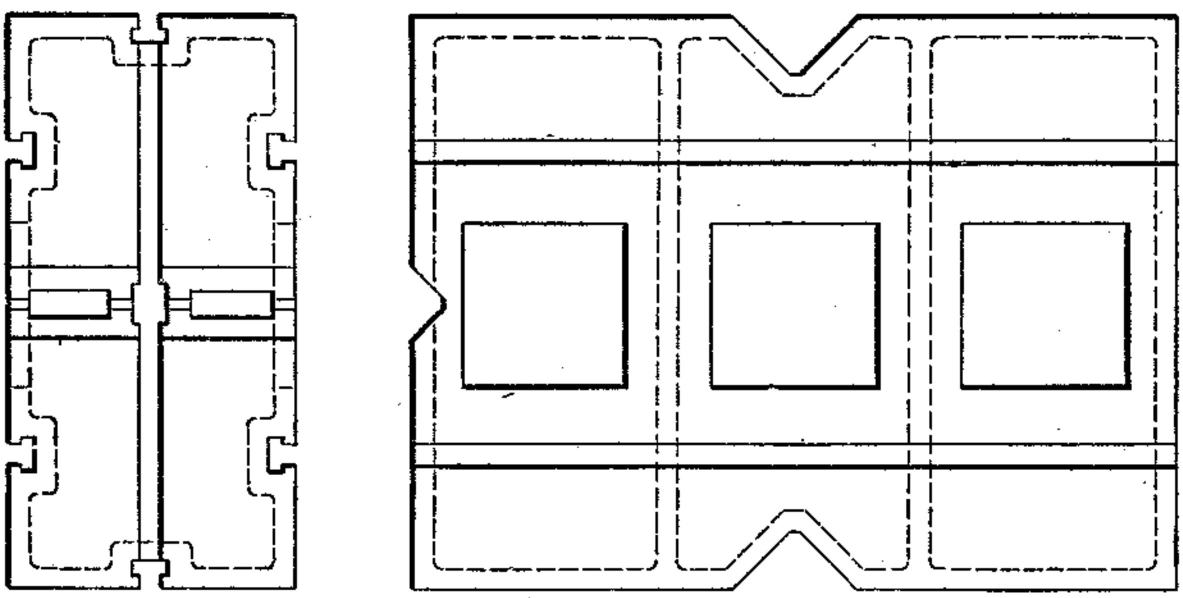
FIG. 3

angles. When a number of such blocks are made, it is advisable to make their corresponding dimensions equal, in order that the blocks may be used in pairs. The block shown in Fig. 2 is to suit the requirements of the work and then form practically a single block. Holes for dowel-pins are drilled in corresponding positions in the four faces of each block. The dowel-pins are made a good fit; they prevent the blocks from slipping on each other and at the same time permit them to be readily separated. One of the dowel-pins is shown at *a*.

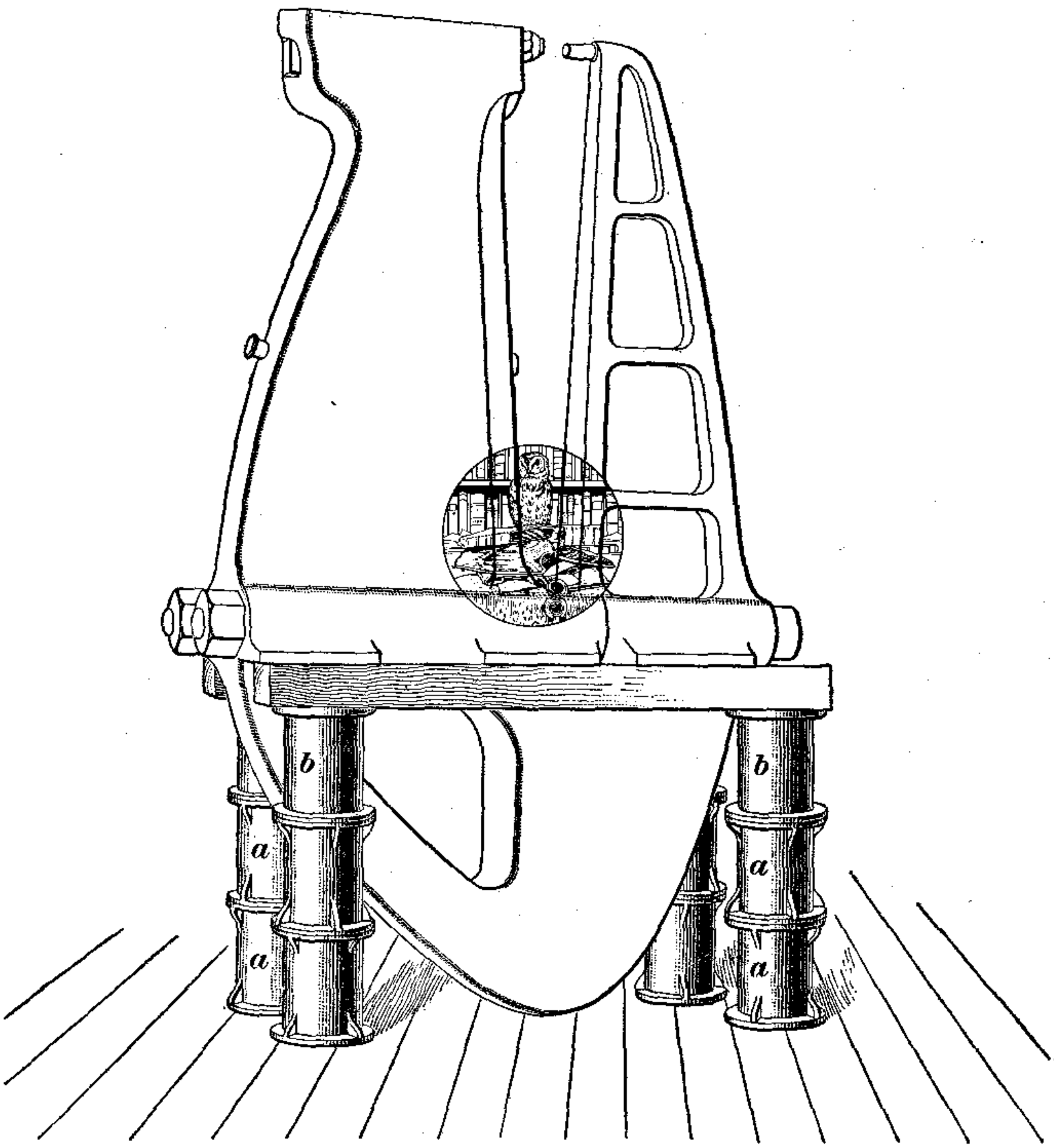

FIG. 4

11. The block shown in Fig. 3 has the general form of a box; it is finished all over and is provided with **T** slots and **V** grooves, as shown. The **V** gooves in the sides permit the block to be used with either side up for round work; the **T** slots allow the work to be fastened to the block, or the block to be secured in position by bolts. Blocks of this type may be used singly, or they may be piled up to any height that the work

12. Cylindrical iron blocking, which is quite convenient for some classes of work, is shown, together with its application to a piece of work, in Fig. 4. The blocking resembles a short section of flanged cast-iron pipe; the sections may have the flanges strengthened by ribs, as, for instance, the sections *a*; or, the flanges may be plain, as those of the sections *b*. The flanges should be faced straight and parallel with each other, and the different sections should all have the same length.

A lighter form of pipe blocking is made of wrought iron or steel pipe that is threaded at both ends to receive flanges. The latter should be faced after they are screwed on the pipe.

13. Trestles.—The trestle is used as a support for large, but comparatively light, work. It may be made as is shown in Fig. 5. The legs should be cut so as to leave a shoulder *a*, and should be bolted to the beam *b* by bolts passing through the legs and the beam. When constructed in this way all the stress does not come on the bolts. When great stiffness is desired, or when the weight to be supported is rather heavy, the legs may be tied together near the bottom by boards nailed across them.

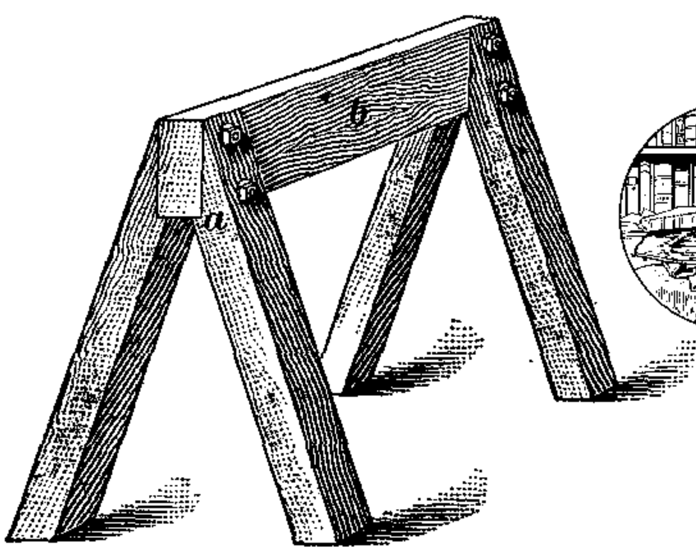

FIG. 5

JACKS

14. In addition to the parallel blocks just described, the lifting device known as a **jack** is almost indispensable in all kinds of floor work, especially in erecting. Jacks are made in a large variety of styles and sizes, from those intended for leveling up light work on the tables of machine tools to the heavy screw jacks and hydraulic jacks capable of raising or supporting 500 tons or more. They are used for a wide range of work.

15. Simple Leveling Jack.—The simplest form of jack the bottom and has a tapped hole through it. A square-headed screw *b* with a slightly rounded top, as shown, is used for raising the work. This style of a screw jack is employed principally in leveling up work on the tables of machine tools, although it will be seen later that similar jacks are sometimes made in large sizes and used in erecting.

When in use these jacks are set on the table of a machine tool in their proper positions; the work which is to be machined is then placed on them and leveled with the aid of a level or other device, the screws being turned up or down as required by means either of a wrench applied to their heads *b* or by a bar thrust through the holes *c*.

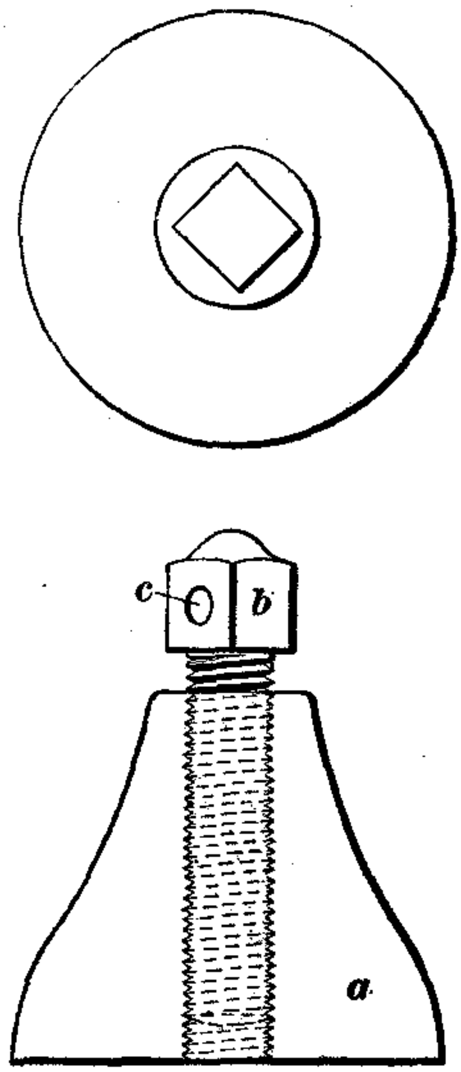

FIG. 6

16. Adjustable-Top Leveling Jack. A small jack, with an adjustable cap, which is very serviceable for machine-tool work and light assembling, is shown in Fig. 7. The body *a* is tapped to receive the adjusting screw *b*, which has a square top and holes for the rod *c*. The cap *d* is attached to the screw by a ball-and-socket joint, so as to permit the cap to accommodate itself to the angle of the work. When a solid or conical top is more

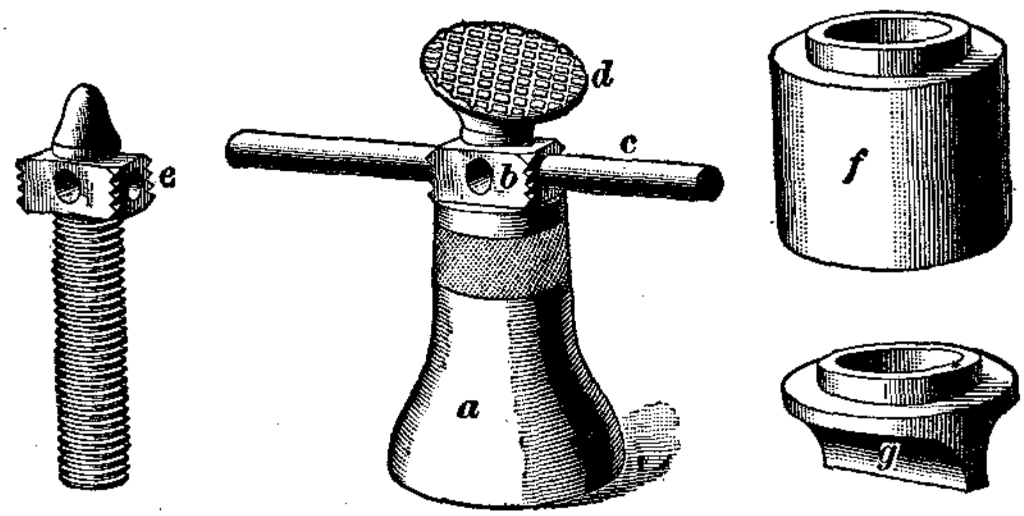

FIG. 7

suitable for the work, a second screw *e* is substituted for *b* the auxiliary base *f*, which may be placed under the jack when a greater height is required. Auxiliary bases of different heights may be used as needed. A special base *g* is used where a good footing for the larger base cannot be obtained.

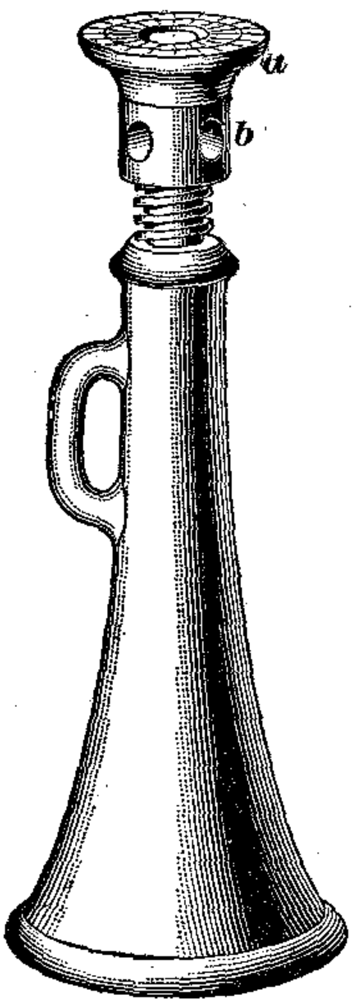

FIG. 8

17. Screw Lifting Jack.—When jacks are required for lifting, a different design with a greater screw travel becomes necessary, of which Fig. 8 is an illustration. The head of the screw is made with a cast-iron cap *a* that rests on a solid collar *b*; the upper end of the screw is turned down to pass through the cap and is beaded over to prevent the cap from coming off. A round bar inserted in the holes at *b* is used to turn the screw.

18. The jack shown in Fig. 8 can be used with a straight handle only where the screw can be turned through an angle of at least 90° at each setting of the bar. By bending one end of the bar through an angle of 22½°, and inserting the bent and straight ends alternately, the angle through which the screw turns for each insertion of the bar is greatly reduced. The jack can thus be operated in a comparatively narrow space; but the constant resetting of the bar consumes so much time that this method becomes objectionable where much work of this kind is to be done. Much time and hard work is saved by the use of a jack fitted with a reversible ratchet for operating the screw, as the handle of the ratchet can be turned back more easily and quickly than a bar can be removed,

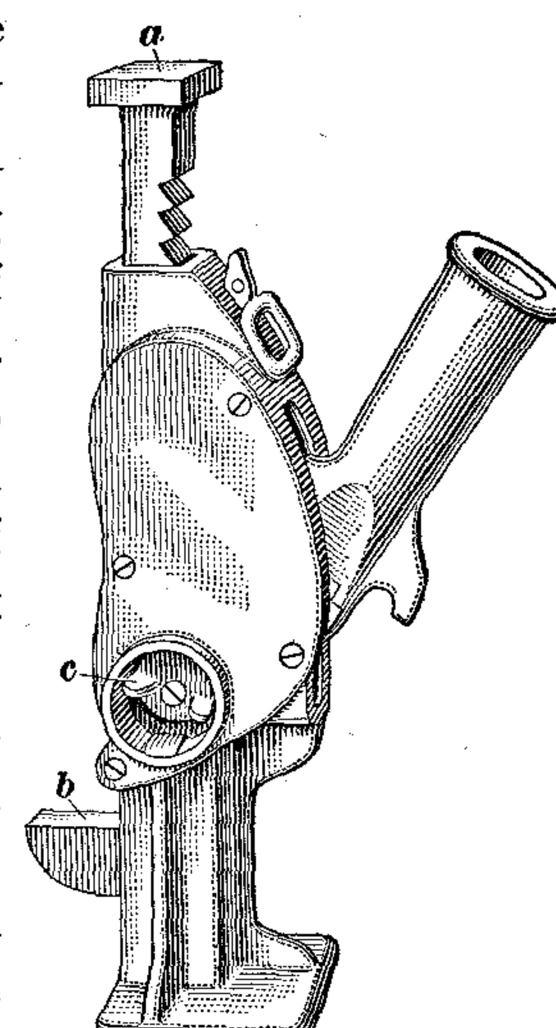

FIG. 9

formed ratchet, the jack can be operated in a very much smaller space than one operated by a detachable bar.

19. Ratchet Lifting Jack.—A typical form of ratchet lifting jack is shown in Fig. 9. Jacks of this class are used for various kinds of work. The load is carried by either the head *a* or the foot *b*, and is raised or lowered by means of a pawl and ratchet operated by a handle bar not shown. The load is raised or lowered on both the upward and downward stroke, the direction being controlled by the eccentric *c* at the side of the frame. These jacks have capacities as great as 20 tons.

20. Geared, Ratchet, Screw Lifting Jacks.—For capacities of from 20 to 70 tons, geared ratchet screw, or hydraulic, lifting jacks are usually employed, instead of jacks of the types heretofore described. The introduction of gearing enables greater leverages to be obtained, with consequent greater ease in raising or lowering the work. Fig. 10 shows a geared jack having a stationary steel base *a* over which is placed a sliding sleeve *b*, also of steel. The base is hollow and has in its top part a removable bronze nut *c*, in which the steel screw *d* turns. A steel bevel gear *e* is fitted to the upper end of the screw and upon it rests a hardened steel plate *f* on which are placed circular trains of hardened steel balls *g* held in position by steel rings *h*. A second hardened-steel plate *i* rests in turn upon the balls. The sliding sleeve *b*.

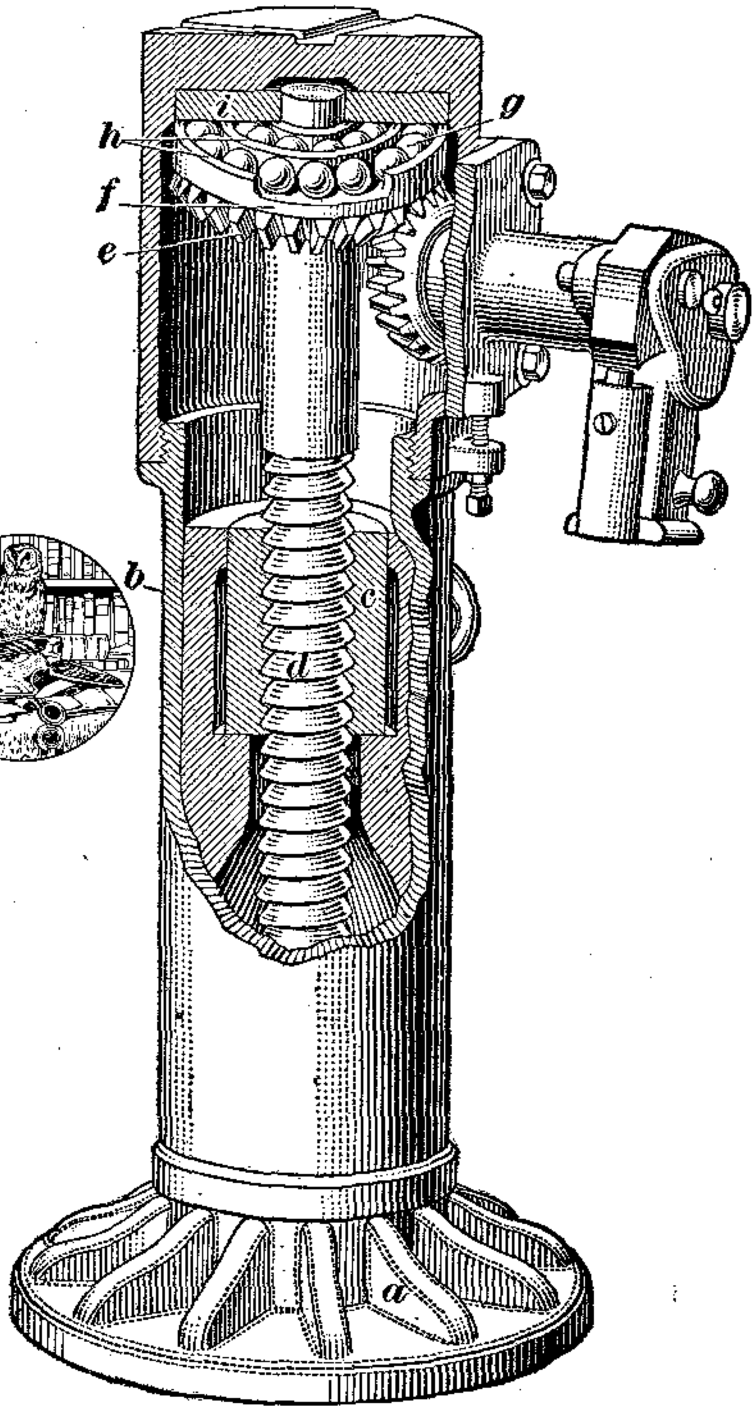

FIG. 10

this upper steel plate. The sleeve is raised and lowered by the screw which is turned by means of a reversible pawl and ratchet in a handle bar, not shown, operating through the pair of bevel gears.

21. Hydraulic Jacks.—Different kinds of hydraulic jacks are used very largely in machine shops. They are operated by

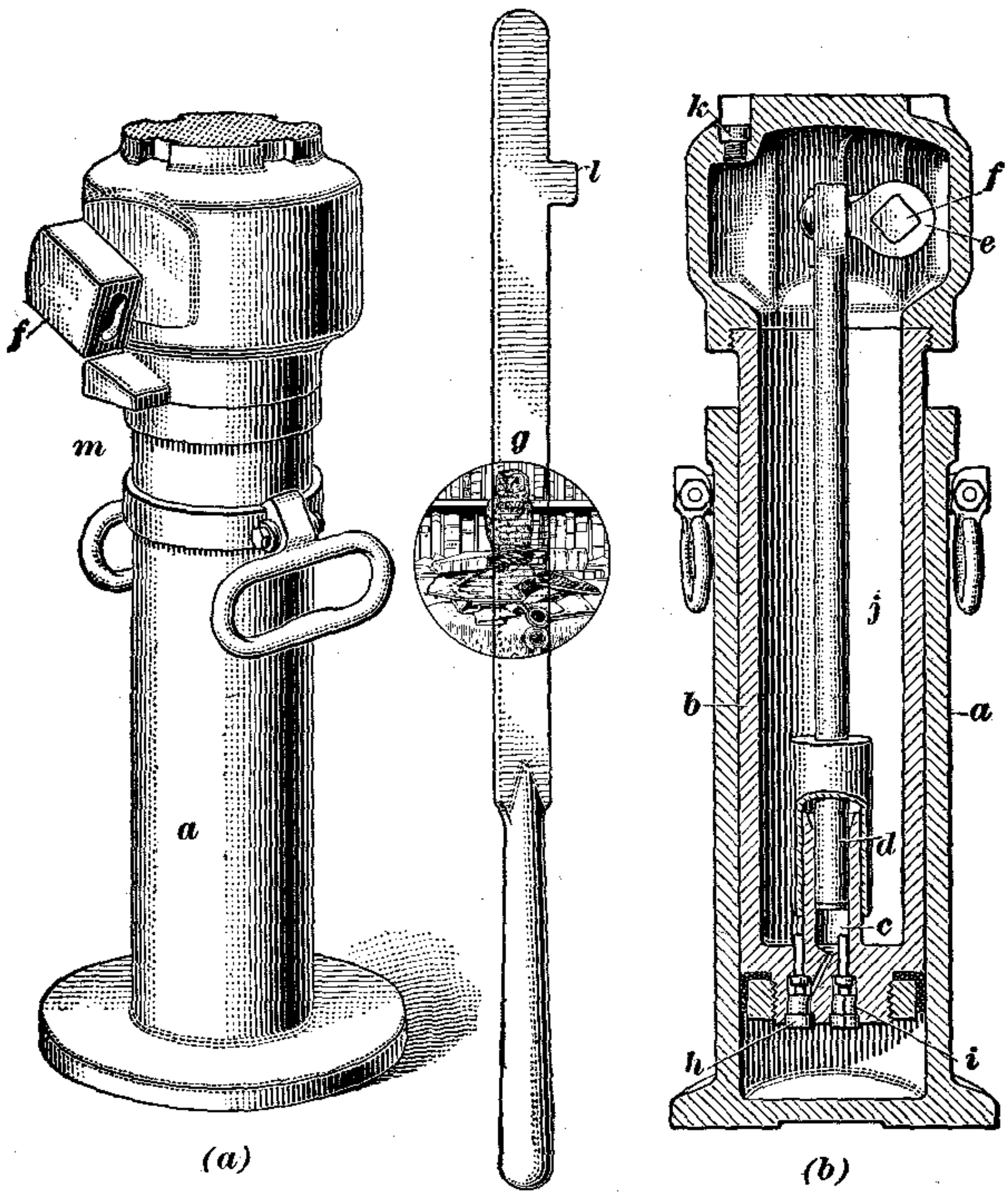

FIG. 11

pumping oil or other liquid under a piston or ram. When hydraulic jacks are subjected to cold temperatures, alcohol must be used, on account of its resistance to freezing. The lifting is done by the pressure of the fluid in the cylinder. In Fig. 11 (*a*) and (*b*) is shown a type of hydraulic jack consisting of a forged steel cylinder *a* in which is a hollow steel piston or ram *b*, free to move up or down. At the bottom of the ram and which is fitted a plunger or rod *d*, and this is in turn connected by the piece *e* to the part *f*, which receives the operating lever, or handle bar *g*. Two small valves, *h* and *i*, for suction and discharge, respectively, are located in the bottom of the ram, the suction valve *h* connecting the oil reservoir *j* in the ram with the small central cylinder *c*, the discharge valve *i* connecting the small cylinder *c* with the large outer cylinder which contains the ram. While the ram is in its lowest position, it is entirely filled with liquid, which is poured into it through a small screw plug *k*, shown at the top. In summer a mixture of 1 part grain alcohol and 4 parts distilled water by volume is used, while in winter the proportions used are 2 parts of alcohol to 3 parts of water. A small amount of sperm oil is usually added in either case.

22. To operate the jack, the lever, which has been placed in position with the lever lug *l*, Fig. 11, pointing downwards, is lifted, which raises the plunger, drawing oil from the reservoir through the suction valve and into the small central cylinder, the discharge valve remaining closed. On the downward stroke of the lever, the plunger is pushed down until the lug *l* comes in contact with the lug *m*, which forces the oil from the small central cylinder through the discharge valve into the bottom of the large outer cylinder, the suction valve remaining closed. As a result, the ram is raised an amount equal to the volume of oil displaced from the small central cylinder. It must be understood that this distance will not be equal to the travel of the piston, but will be as much less as the volume of the large outer cylinder is greater than the volume of the small one. To release the jack, the lever is reversed so that the lug on it projects upwards, thus allowing the plunger to be forced further down than is permitted in its regular stroke, which causes the plunger *d*, with its surrounding sleeve, to press on both valves, opening them and allowing the oil to return to the oil reservoir. Hydraulic jacks are built for capacities ranging from 10 to 500 tons. Their principal advantage over the geared type, in addition to their greater range of capacity, is that they are requiring a little more care for their proper maintenance. They should be used only for temporary service, as there is a tendency to leak and reduce the pressure, in spite of the best of care.

FOUNDATIONS, FLOORS, AND PITS

FOUNDATIONS

23. Temporary Foundations and Temporary Erecting.—The erecting of a machine is usually understood to include both the first erecting, in the shop where it is built, and the second erecting, on its final foundation. The two differ principally in the amount of fitting and adjusting that is requisite and the facilities for handling the heavier parts. The fitting and adjusting of all the parts are done in the shop, except in cases where some of the parts are dependent on the foundation, or must be fitted to other parts that are not available in the shop. The temporary foundation on which the work is erected in the shop is either an *erecting floor* or a *floor pit*.

24. The machine should in all cases be made as complete and as perfect as possible before it leaves the shop, because the entire equipment of the shop is available and the work can be done to better advantage, whereas any fitting necessary while setting up the machine upon its final foundation must be done with a few light tools that can easily be shipped from the shop and with such devices as the workmen may be able to contrive. The ingenuity of the erecting force is often severely tested, and the most skilful workmen frequently find it impossible to produce the grade of work that could readily be performed in the shop at a much smaller cost. It is therefore a matter of economy to be certain that every part is properly fitted and the entire machine is as complete as possible before it is shipped. The erecting on the final foundation should consist simply in putting the parts together and in making the final adjustments. This is, at best, not an easy task, especially when the machine is heavy, as the facilities for handling are almost invariably

25. Permanent Foundation and Foundation-Bolt Templet.—The permanent foundation is usually built of concrete, brick, stone, or steel. In building, due provision must be made for the foundation bolts. Sometimes these bolts are built solidly in the foundation, while at other times they are set in pipes that hold the concrete or cement while it hardens, yet permit the bolts to be adjusted or removed entirely, if necessary. In either case the bolts must be carefully set, so that when the bed of the machine is lowered in place they will meet the bolt holes. It is usually best to make a wooden templet having the exact thickness of the bed parts, with holes in the exact location of the bolt holes in the bed through which the bolts pass. By locating such a templet carefully where the machine is to stand, the bolts can be set to the proper height and in the right places; the foundation may then be built up without any danger of a misfit.

ERECTING FLOORS

26. Foundations for Erecting Floors.—The erecting in the shop is done on a floor, the construction of which depends on the weight of the machines and the condition of the earth on which the floor is built. When the earth is dry and hard, or there is a rock bottom to build upon, the foundation of the floor may be shallow; on the other hand, when the earth is wet or unstable, a deep and solid foundation should be built up. The depth of the floor foundation depends on the weight of the heaviest parts that are liable to rest upon it.

27. Kinds of Erecting Floors.—Erecting floors are made in different ways, depending on the class of work to be done; that is, whether they are intended for permanent use for one class of work, or for a wide range of work, the needs of which cannot well be anticipated and for which changes must constantly be made. The first cost, also, often becomes an important factor in determining the style of floor to be used. To meet the various requirements, the following kinds of floor are made: *earth*, *wooden plank*, *scantling*, *wooden block*, *brick*, *con-*

28. Earth Floors.—Where the earth is of a firm and solid character and little money can be spent for a floor, the earth may be leveled and packed down so as to make a smooth, hard floor. Sometimes the surface is formed of a layer of iron chips from 1 to 4 inches thick that are mixed with salt or other material that will cause them to rust. When they are well packed, the surface will rust into a solid, smooth mass and then form a very good floor. Besides being cheap, the earth floor can easily be dug up to form a pit to enable any machine parts that project below the floor line to be attached. On the other hand, there is always more or less loose sand upon the surface,

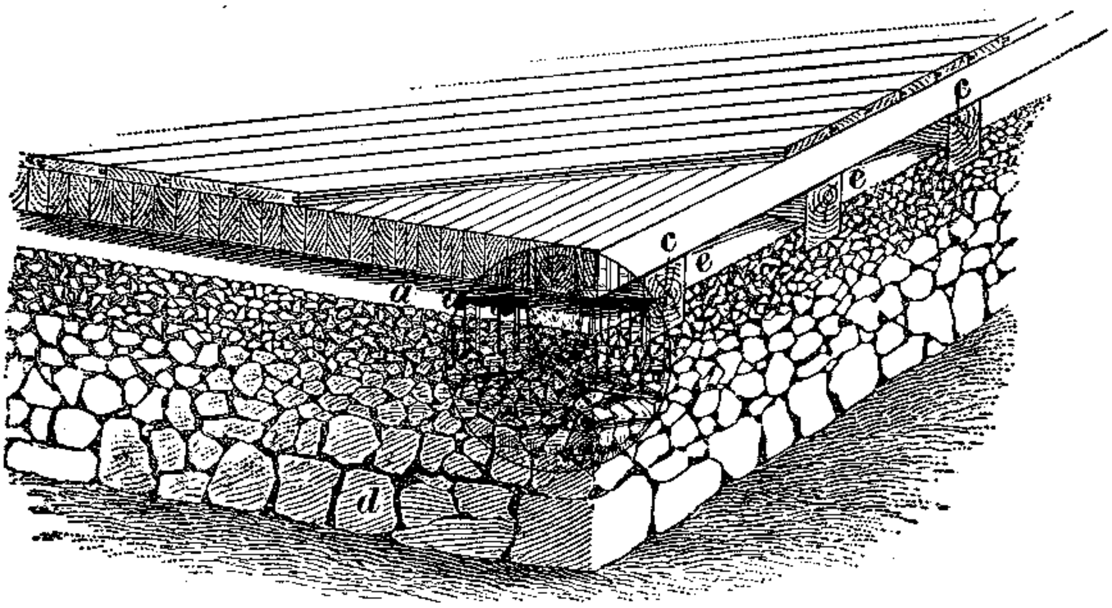

FIG. 12

which is liable to get into the working parts of a machine and cause trouble.

29. Single-Plank Floors.—A comparatively inexpensive floor consists of 3- or 4-inch yellow pine planking, laid across joists that are placed close together and are well braced or bridged sidewise. The planks are sometimes covered with a diagonal floor of $\frac{3}{4}$- to $1\frac{1}{4}$-inch pine. The spaces between the timber should be ventilated to prevent rot. Such a floor is, however, not very rigid, and hence the heaviest grades of work require something more solid.

30. Double-Plank Floors.—A more rigid floor than the plank floor previously mentioned is illustrated in Fig. 12. The floor is built up of $2'' \times 4''$ pine scantling *a*, with a facing of from $\frac{3}{4}$- to $1\frac{1}{4}$-inch pine boards laid diagonally, as shown. The bed. These timbers are made 4 in.×4 in., 4 in.×6 in., or 6 in. ×6 in., depending on the duty for which they are intended. When the 4″×6″ timber is used, it is laid on its flat side. The thickness of the concrete depends largely on the condition of the ground. If the ground is of a firm grade, 14 inches of concrete should be sufficient for all ordinary purposes. The bed is built up by first laying a course of coarse stone, as shown at *d*, and running in some cement, then following with successive finer grades of broken stone and concrete, and finishing with a fine grade of concrete. Air spaces *e* are left between the timbers; these may be ventilated by means of openings through the walls or by holes bored through the floors. Many persons claim that this precaution should be taken with all wood floors to prevent rotting. The distance between the timbers should not be much greater than the thickness of the concrete, and it is generally thought best to limit the distance to the thickness. Excellent floors are made in this way.

31. Tar Concrete Floors.—A very good floor is made with a base of tar concrete. The ground, after leveling, is covered to a depth of about 6 inches with a layer of sand that is well rolled down. On this, 6 inches of tar concrete is placed; the concrete is composed of small broken stones covered thickly with heated tar, and, after leveling, is rolled with a heavy roller. Finally, a layer of sand mixed with considerable tar and some asphalt is applied, while hot, to a depth of about 1½ inches and after it is rolled down, is allowed to harden. When hard, a layer of 3-inch spruce planking is placed on top of the asphalt, and 1⅛-inch dressed maple flooring in strips about 4 inches wide is finally nailed crosswise to the spruce planking. The maple flooring is not tongued and grooved. No air space is left between the concrete and the flooring in this design, and the planking is laid directly upon the concrete. The tar will tend to make the foundation water-proof. The quality of lumber used and the amount of dampness in the location are important factors to be considered when deciding upon the kind of floor to use. A tar concrete floor is rather

32. Wooden-Block Floor.—A substantial floor may be made of sawed wooden blocks, either cedar, pine, or oak, that are placed on top of a concrete bed. After tamping and leveling the ground, a layer of cinders 6 inches thick is placed on it and thoroughly rolled down with a heavy steam roller. A bed of concrete 4 inches thick is then laid on top of the cinders and leveled. The blocks may be about 6 in.×4 in.×4 in., and sawed from well-seasoned oak; their ends are dipped in liquid asphalt, and then laid directly on top of the concrete bed.

33. The cinders may be omitted and the concrete bed placed directly on the leveled ground, making it about 8 inches thick. The blocks are sawed to 3 in.×12 in.×5 in., and are placed end to end and butting together on the concrete, so that their height is 5 inches. A space of $\frac{1}{4}$ inch is left between the adjacent rows, which is filled with a mortar composed of 1 part of Portland cement to $2\frac{1}{2}$ parts of sand.

The advantages of a wooden-block floor are: (1) It is easy on the feet of the workmen. (2) The work is less liable to slip on it than on other kinds of floors. (3) Cleats, braces, etc. can be attached readily to the floor. (4) The expense of repairing is slight.

34. Brick and Concrete Floors.—Occasionally, a floor is made of brick laid in cement and placed on a solid concrete foundation. Sometimes hard paving bricks laid on edge are used instead of ordinary bricks, and cement is run in to fill the cracks. In some localities, a concrete base is covered with a thick layer of cement, which forms a very smooth and hard floor that is practically impervious to moisture.

An excellent and comparatively inexpensive floor consists of a layer of concrete from 8 to 12 inches thick laid directly on the ground, well tamped down, and leveled. A layer of sand about 1 inch thick is laid on the concrete, and a layer of concrete brick on the sand.

35. Cast-Iron Plate Floors.—Perhaps the best floor for large work is the cast-iron plate floor; but its great expense is warranted, since it serves as a laying-out table and a temporary machine foundation, as well as an erecting floor.

The plates are generally made stiff enough to allow them to be supported upon masonry columns without deflection. The leveling up of the plates is thus greatly facilitated when they get out of true. Sometimes they are laid in a solid bed of concrete. The plates are then supported at every point, and when the foundation is heavy, and the plates are leveled up very carefully when they are first set, the floor is quite satisfactory for some time; but if the foundation should yield slightly, or the plates should not be set quite right at first, it is impossible to set them true without taking up the whole floor and resetting it completely. Since this is a very expensive piece of work, the masonry supports with openings between them that make all parts below the floor accessible are generally preferred.

36. The top of the floor should be planed true, and should be provided with **T** slots so that the work or portable machines may be bolted to it. The slots are usually made at right angles to each other, although sometimes they are all made parallel to one side; occasionally, when much circular work is to be machined upon the floors, the slots are run in concentric circles with radial slots crossing them at regular intervals. A board flooring is sometimes laid over the unoccupied portions of the cast-iron floor plates, to preserve them the better from damage.

FLOOR PITS

37. Use of Floor Pits.—When erecting large work provision must be made for parts that extend below the floor line, or means given to reach some of the parts from beneath the machine. For this purpose, pits are made at suitable places in the floor. Cast-iron floors are often made about the edges of these pits, which are frequently lined with plates with **T** slots running down at intervals on the inside. Pits are also used in machining very large pieces, such as flywheels, that are too

38. Construction of Floor Pits.—The construction of pits, like the construction of erecting floors, depends very largely on the class of work done in the shop. When a definite line of manufacture is carried on, a pit suited to the needs of the work can be built; but where work of a miscellaneous character is done, it is impossible to anticipate the needs that may arise at any time, and a pit that can easily be enlarged or changed will be most suitable.

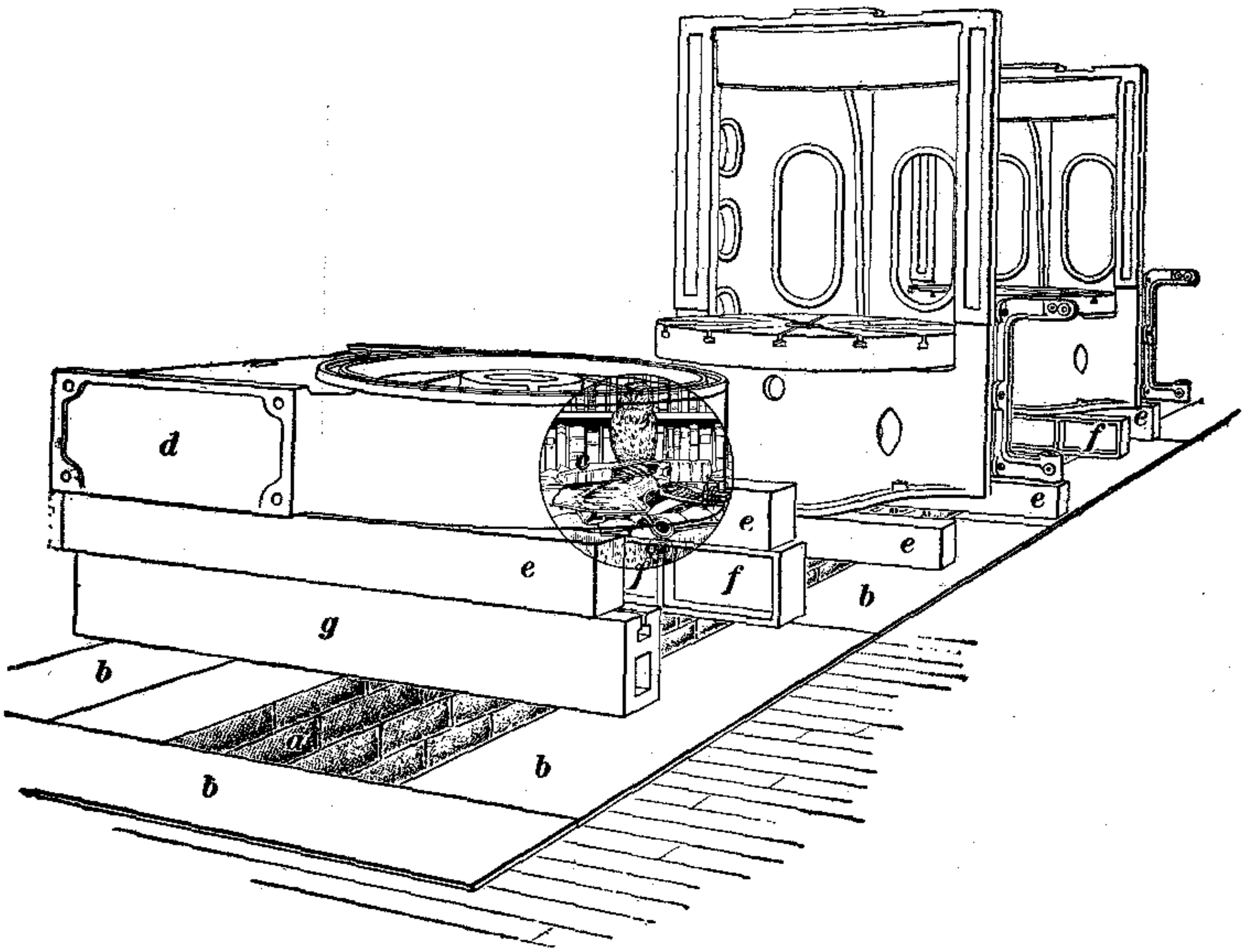

FIG. 13

39. Pit Construction for a Definite Line of Work. Fig. 13 shows a pit that is built for the purpose of erecting vertical boring mills. The sides of the pit *a* are built up of brick or stone, and iron plates *b* are placed all around the mouth of it, as shown. A convenient size of pit for this class of work is made about 4 feet deep by 4 feet wide; the length depends on the amount of work to be done.

40. The bed of the machine that is being erected is usually mounted on parallels placed across the pit. Two styles of attached to the sides of the bed at *d*, and the table is rotated on a spindle that extends below the bottom of the bed. The lower end of the spindle is carried in a step bearing that is placed in a frame which is bolted to the bottom of the bed. To fit this frame properly, there should be plenty of room beneath the bed, which is therefore placed on two parallels on each side. The two machines that are shown in the rear are self-contained. The housings and the bed are one casting, and the spindle of the table does not extend below the bed. In this case, one set of parallels is sufficient to support the machine during erection.

41. Large Parallels.—Fig. 13 illustrates several styles of large parallels. The parallels *e*, which are made of cast iron, have the general form of a box that is open at the bottom and is subdivided into several compartments by webs. These webs tie the tops and sides together and greatly stiffen the parallel. The object of making the parallels hollow is to reduce their weight. It is an advantage to have all the parallels in a set of the same height, since three or more can then be used for supporting a large piece of work having a plane surface at the bottom.

The parallels *f* have an **I** section and are strengthened at regular intervals by ribs, as the one shown at *f'*. A large parallel, as *g*, is occasionally made with a rectangular hole and a **T** slot cored in it. The **T** slot permits work to be attached to the bar by means of bolts and clamps.

42. Large Masonry Pit.—Fig. 14 shows a masonry pit intended for large and heavy work. A pit about 40 feet long, 12 feet wide, and 20 feet deep is a size well adapted for heavy work. The ends *a* and the sides *b* may be built up of stone, while the bottom *c* is made of concrete and faced with cement. The top of the pit is surrounded with cast-iron plates *d* that are planed and set level. These plates are provided with **T** slots by the use of which the work may be secured to them. The ends of the pit may be built up in steps, as shown, or may be

43. When not in use, the pit is covered with a plank floor, a section of which is shown in place at *f*, Fig. 14. The floor is supported upon **I** beams, as *g*, which are set in pockets *h*, in the sides of the pit. The covering floor is made up in sections so that it can easily be removed, and each section is provided with two rings *i* to facilitate the handling. The rings are attached with staples and let into the plank, so that when not in use they lie below the surface of the floor. Where the pit is not floored

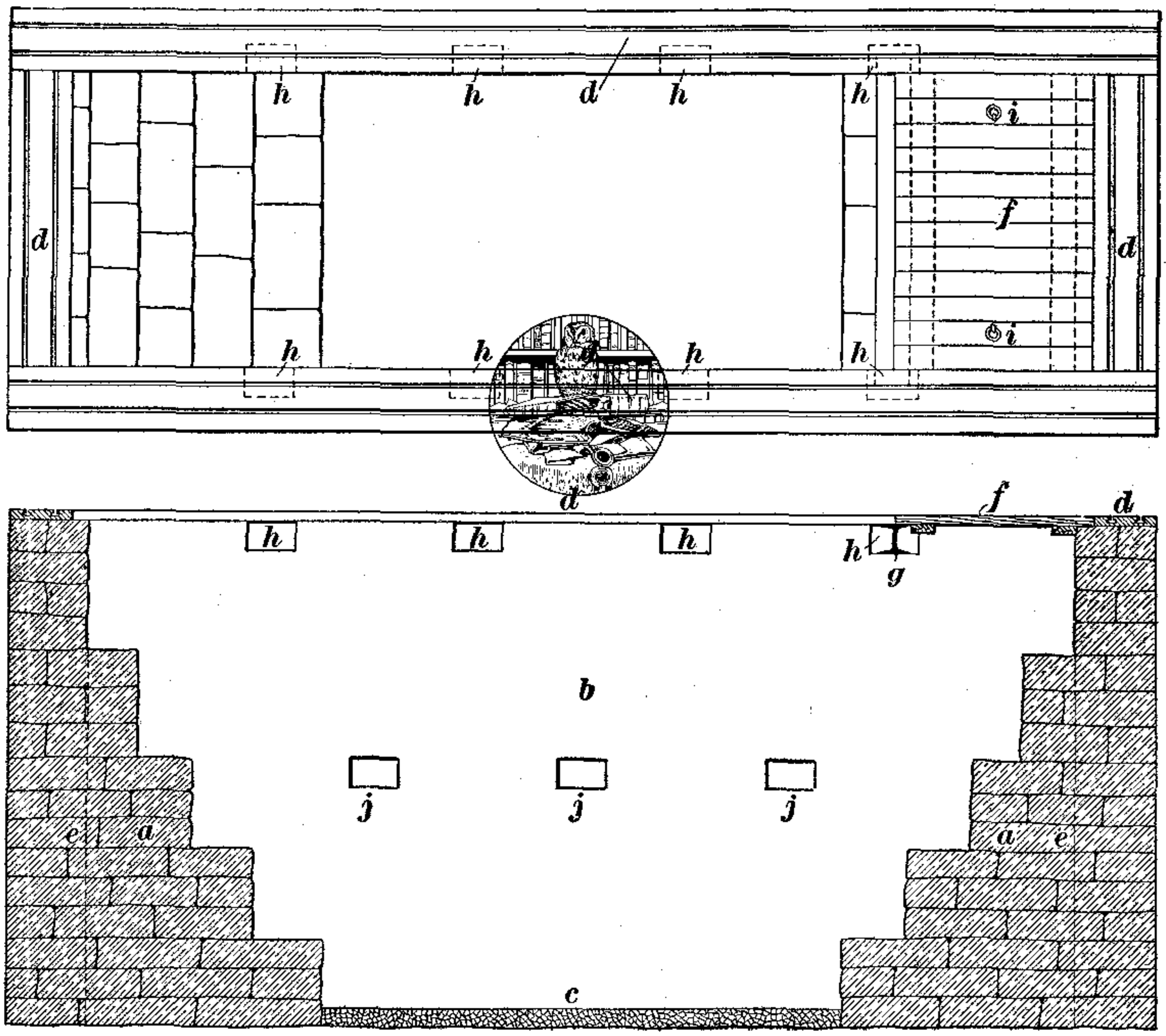

FIG. 14

over, it is advisable to place a stout removable hand railing around it to prevent workmen from falling into it. These pits may be made with one or more sets of pockets *j*, to receive the **I** beams, upon which to support sections of the floor when the full depth of the pit is not required. Such a pit may be used either for erecting or for machining large parts. This form of