THE EFFECT OF SIZE ON THE EQUIPMENT OF THE QUEEN'S DOLLS' HOUSE

BY
MERVYN O'GORMAN

THE DINING ROOM

THE MEASUREMENTS ARE 42¼ INCHES LONG, 20 INCHES WIDE, 15 INCHES HIGH. THE CHAIRS STAND 3 INCHES HIGH AND THE TABLE 2½ INCHES. CEILING BY GERALD MOIRA, A.R.M.S. PORTRAIT OF H.R.H. THE PRINCE OF WALES, OVER THE MANTELPIECE, IS BY A. J. MUMINGS, A.R.A.; THE GROUP AT THE END OF THE ROOM—A COPY OF WINTERHALTER'S "QUEEN VICTORIA, THE PRINCE CONSORT AND FAMILY," BY AMBROSE MCEVOY, A.R.A.; THE PORTRAITS ON EACH SIDE OF THE MANTELPIECE, EDWARD III. AND JAMES V. OF SCOTLAND ARE BY SIR WILLIAM LLEWELLYN, K.C.V.O., R.A.

THE EFFECT OF SIZE ON THE EQUIPMENT

MEN of every age and time have their interest aroused by miniature models of even quite commonplace things. The Egyptians have left dolls, none the less instructive for being roughly shaped, illustrating every occupation and pastime of their period. So have Indians, Chinese and Japanese, each with a delicacy of detail which shows their love of the miniature, and so have the Western peoples of all dates.

Who has not carried away a terrible and ineffaceable memory from that room in the Bargello at Florence where the episodes of the Plague receive a ghastly resuscitation from the skill of the model maker? The story has been written of a pretty Japanese lady who dwindled in size till she was a foot high; it tells of the dainty home her husband built for her, wherein her perfections were not overshadowed by the disproportion of her surroundings. We need not follow the vicissitudes of her love story unless it be to recall that after a picturesque episode it ended happily for all concerned.

Among the many writers who have visualised human life on a diminutive scale I have not yet found a record of serious thought given to the peculiar conditions of living which mere smallness entails. I am omitting Sir Wm. Crookes, who in a lecture of surpassing suggestiveness discusses the outlook of a microscopic man, whom he calls an "homunculus"; but then he was dealing with a personality some thousand times smaller than would be the châtelaine of the Queen's Dolls' House and her retinue, with whom I am now concerned. In the course of the present chapter I shall require a name for the race who should inhabit the new small world that our British Queen has inspired, and the many contributors mentioned in this book have helped to create. Being at a loss I turned to a bright little girl, among the children of my acquaintance, "What shall I call the race of people who live in the Queen's Dolls' House?"

"*I* should call them the 'mites' for short . . . but *really* they are the Dollomites," was the reply.

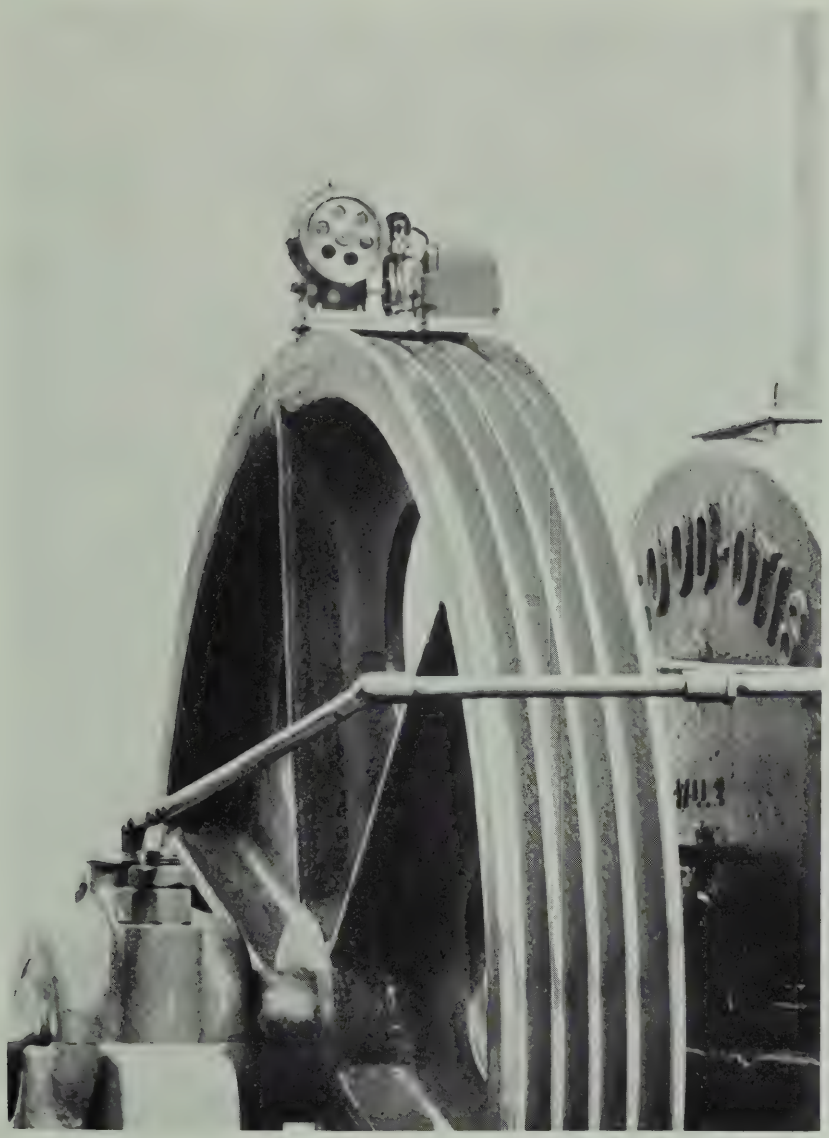
The answer was not without the appeal of contrast to anyone who had been awestruck by the steepness, the solitude and the magnificence of the great mountains whose name she so closely plagiarised. The Queen's Dolls' House is one-half the size of that of the Japanese lady of the legend, and its dwellers one-half as high as she and one-eighth part of her weight. The châtelaine of the Queen's Dolls' House is a tall woman, $5\frac{3}{4}$ inches high, and her "Dollomite" men-folk six inches, to correspond with a human stature of six feet.

Now what peculiarities would follow from their being one-twelfth of our natural size?

To begin with, the Dollomites, if made of flesh and blood with hearts and lungs like ours, would be remarkably powerful—as we judge strength. They would move a gilded chair, a lacquer table, or a pianoforte as easily as we pass a tumbler of water, a decanter, or a footstool—they would romp upstairs with one-twelfth of the effort it would cost us, and so might be expected to neglect the electric lifts which could take them from floor to floor by pressing a button.* When I say "neglect," I see no reason to suppose that they would not appreciate the remarkable craftsmanship of the maker who contrived in this small compass to get a working model of such lifts as we employ—but the lure of laziness would not often bring them to the lift gates.

After dinner when the men return upstairs to join the ladies in the drawing-room we should see quite elderly persons jump twelve steps at a time and reach their goal without so much as an acceleration of their breathing or their pulse. You see, twelve steps are to them much what one or two steps are to us, and

* The press buttons on the lift which determine the floor at which it is to stop are placed outside the doors on the several floors and not inside the lift cage—for the obvious reason that we cannot insert our hand into the lift cage while it is running. With this omission the correspondence is remarkable. The usual steel ropes are replaced by fine fishing line to secure flexibility. For all details see the Inventory.



THE MODEL LIFT MOTOR

STANDING ON TOP OF THE DRIVING SHEAVE OF ITS FULL-SIZED COUNTERPART

which of us could endure to take one-twelfth of a step at a time when stimulated by the thought of beautiful little ladies upstairs?

Someone might want to know why they should be relatively so strong. It is explainable. A man can work because he can breathe and, by breathing, refresh his blood. This is done by his lungs whose surface is exposed to the air. An important limitation to his activity is imposed by his possible rate of breathing. The oarsman and the runner know this full well. They get "blown," as we absurdly call the fact that they blow hard and fast when they work hard. The area of the windpipe and the area of the lungs strictly limit the rate at which the internal combustion of the air can be achieved, and it is the rate of oxidation which determines the output of power.

The Dollomites have a lung area 1-144th part of what we have, but, and this is the crux of the matter, their body weight is 1-1,728th part of our body weight—leaving them on balance twelve times as strong. The weight of everything about them is similarly lightened; chairs, tables, bottles, pianos, doors, cupboards, clothes, knives and forks, golf clubs and fountain pens, all these things are reduced in weight 1,728 times.

There is a perfect cabinet gramophone and, if it should be wanted upstairs by the châtelaine to entertain her guests with the music from a new and unique record one inch in diameter, which she has recently acquired, a footman brings it in on one hand, as he would a salver with a letter, and be quite unaware that anyone might regard this as a feat of strength. The effect of the cube law of weight is worth noting in a few examples, as we pass them.

Here (Plate XVIII) is the mechanical part of the electric lift in the full scale, and the makers have placed on the top of the large pulley the one-twelfth size model, so that we can compare the sizes. Instinctively we feel that that small dot above the pulley is far less in weight than one-twelfth. Actually if we take the

whole of the frame of the two lifts with their guides, counterweights, cages and electrical gear as shown in Plate XIX in the full scale, that is "life-size," their weight is eight tons, while the corresponding models total together 45 lb. Indeed, they would be only 11 lb. were it not for departures from exact similarity made to facilitate the model construction.*

Certain properties of matter do not scale down comfortably when size is altered; thus, the stiffness of a steel rope would not be diminished sufficiently to work round the small pulleys of the lift. So also we shall find that the clothes, the linen tablecloths, the bed sheets, etc., of the Dollomites, though exquisitely made, of the very finest known materials, are liable to behave as if they had been—from the point of view of these little people—slightly starched. Those of my feminine readers who may have clothed a small doll well know this trouble, and are aware of the difficulty of getting such clothes to "hang."

So, too, they may have noticed that when liquid is poured from minute toy bottles—and there are dozens of good port wine in the Q.D.H. cellars—it is most reluctant to flow, a defect not noticeable in the relationship between the wine and the bottle of our more human moments.

The properties of liquids here in play are viscosity and capillarity, "physical constants" not affected by the scale change to one-twelfth of full size. They are important in the routine of life and we shall see that even table manners may be dominated by viscosity!

At a state function when the Dollomites rise to toast His Majesty the King of England—as they assuredly do—we notice that it is not sufficient for them to tip the glass on to their lips and tongue as is done in the best circles, but—shades of Chesterfield!—they suck the wine out of the glass.

Their smallest glasses, if filled with liqueur, could certainly be turned upside down without any single drop being spilt! To any

* See p. 206 for detailed description of lift.

THE LIFTS AND THEIR FRAMEWORK

one who has looked with anxiety lest an over-filled liqueur glass should spill, on its way to its ulterior destination, there is comfort in the thought—there is even the appearance of economy till we see a Dollomite attempting to empty his glass, to which the majority of his quantum strongly adheres. It is said that the more modern post-war maidens among them stick their tongues out to collect the residues much as a cow sweeps up the contents of her manger, and a copy of the *Dolly Mirror* no doubt shows a pretty débutante in just this attitude engaging a remnant of Chartreuse.

Physical constants are very dominating and insistent attributes of matter, and I see no hope that the table manners of the Dollomites will entirely conform to our standards. Coffee, tea or even water when taken from their small receptacles will seem to them slightly more treacly than they do to us. Cream or thick soup would be so sticky that the soup spoon would be found to lift the plate with it from the table. Clearly we must not impute to boorishness any of their unexpected habits: we should look instead to the causes which have engendered a different standard to ours. Even in the pantry curious things are seen.

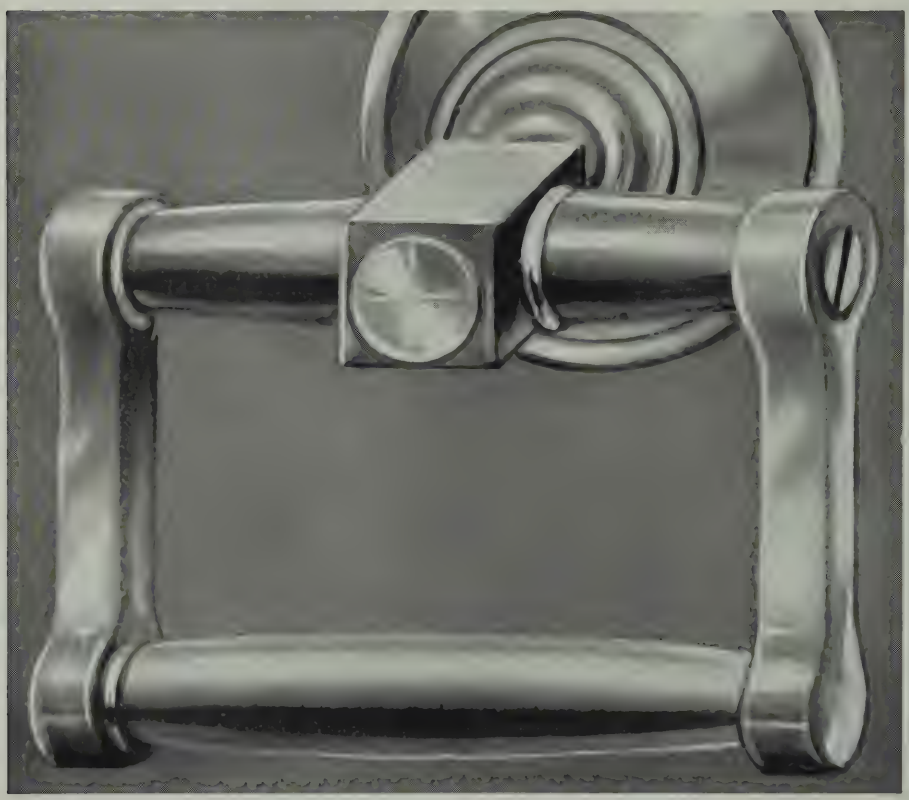
There is a drop of water hanging from the nozzle of the tap, but what a drop! It is nearly as big as the tap itself, that is to say about the size of a large pear. This must make quite a difference when washing up, especially when the dish cloth is nearly as stiff as a man's collar, and as awkward for dish wiping as would be a piece of brown paper to us.

The taps, for all that their usage is commonplace, are exquisite pieces of work. In order that water should flow from the reservoir in the upper part of the house to the various places where it is used, the pipes,which are of extraordinary minuteness, are nevertheless kept rather larger than one-twelfth full size to allow for the retarding effect of viscosity and capillarity on the flow. In full-size houses the drain from all basins, sinks, etc., is bent up into an S shape or syphon so as to prevent the return of

sewer gas into the house. In the Queen's Dolls' House some of these syphons are omitted for a singular reason. When the inside of a very small pipe is dry, it is difficult to wet it, and until it is wet, water will not flow at all. Hence when you turn on the tap, water flows at once whenever the pipe is full of water up to the tap—but the drain pipe is certainly empty and probably dry, and if dry, the basin will overflow into the room rather than empty itself through the proper drain. The syphon would make it very difficult to initiate the wetting of the drain—and is therefore omitted.

Let us turn our thoughts to higher things. The Dollomites, no less than the Queen of England, have amongſt other beautiful jewels a complete regalia, and no less muſt such things be made safe from unauthorised ambitious wearers. I do not think there can be thieves among these fairies, but it would be moſt distressing to the châtelaine to find that the Koh-i-noor, or the Royal Crown, had been borrowed for a fancy-dress prank such as fairies are addicted to—when it was in demand for a State function. Hence we find a ſtrong room, the door of which conſtitutes the firſt line of defence, and within the room a grille for the protection of the Regalia, and a safe for the keeping of the private treasure.

I have a certain pleasure in writing these two laſt words, which are amongſt the moſt satisfactory in the English language, and they immediately summon to their side the word *safeguard*. To do this the folding grille gates, which allow the main door to be open for ventilation in the daytime, are fitted, and the model is in perfect proportion to the original even to such details as the number and size of the bolts. No particular allowance is made for the fact that Dollomites are twelve times as ſtrong as men, but in any case there is a good margin of ſtrength, and protection is provided againſt every type of burglar's tool. The effective lock is in the right-hand door and the bolts of this door engage and control the bolts of the left-hand door by an ingenious



THE MODEL SAFE

AND THE HANDLE OF A NORMAL SAFE
BOTH ACTUAL SIZE

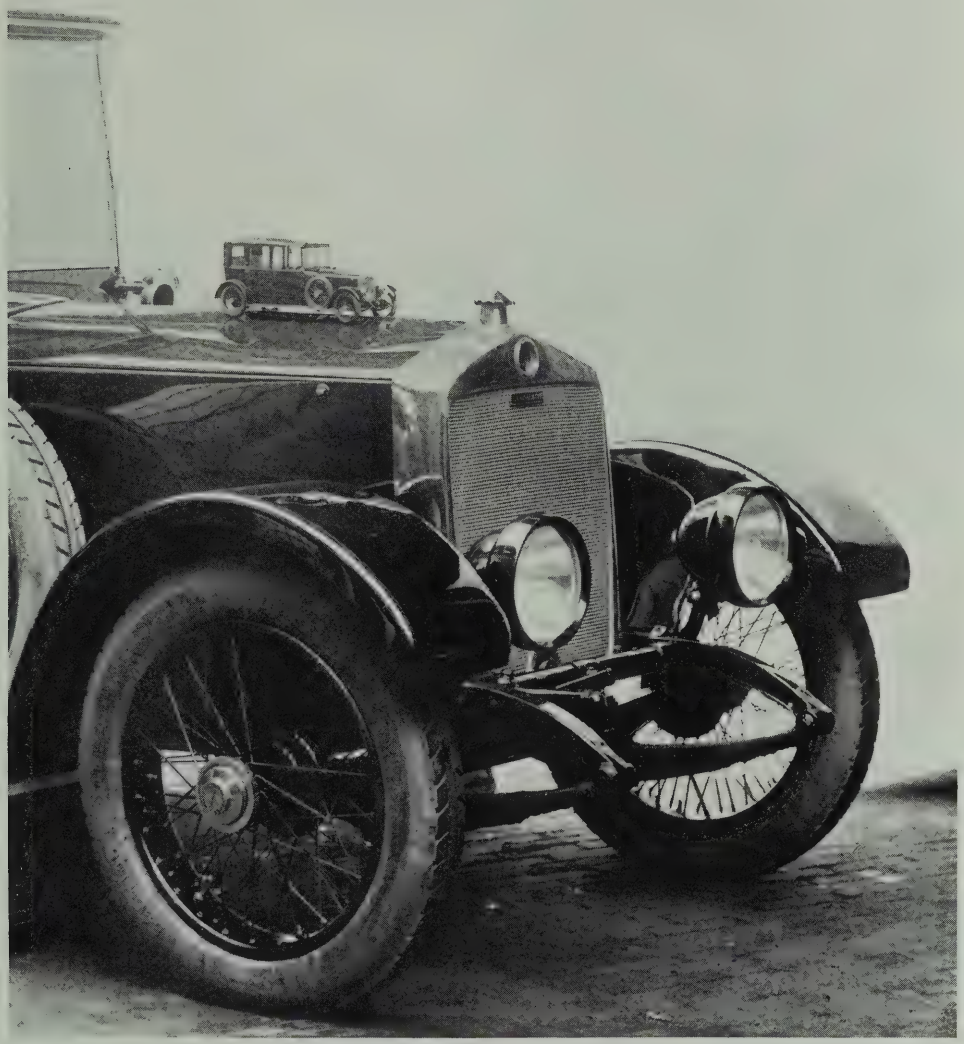
locking bar, as is done against human robbers; only the robbers would have found a grille weighing over half a ton against a pound and a half in the Dolls' House!

The Dollomites are perfectly honest folk, so that instead of using a 10-lever lock a 3-lever one suffices. There is another reason, too, for it is absolutely impossible to make a lock or a key of which each step is about as thick as the paper this is printed on! Indeed the lock is wonderful enough to command all admiration and we can rejoice at the coincidence which makes the impossible unnecessary. A photograph, Plate XX, shows the relative sizes of the model safe and the actual, and gives an interesting comparison. One fact it does not reveal, namely, the difficulty introduced by *paint*. Paint refuses to look right if reduced to one-twelfth thickness, yet the appropriate colour and glaze is required by the good taste and daintiness of the Dollomites. Thus we must make up our minds, when things are painted, be they safes, or grilles, or motor cars or lacquer furniture, that a thickness which we would call preposterous is a commonplace to the little folks. Scaled up to full size the paint would be not much less than $\frac{1}{4}$ of an inch thick on many objects. But you, my reader, would possibly not have thought of it, had I not pointed it out, so this departure from proportionality cannot be deplored as significant or as detracting from your enjoyment of the accurate model presentment of a twentieth century house.

At the disposal of the châtelaine are three motor-cars precisely similar to those we use in this year of grace 1923-24 in all visible particulars. Plate XXI shows her Lanchester riding pick-a-back on its big 40-horse-power brother; the big brother weighs 5,000 lb., and were it not for differences due to dissimilarities which do not meet the eye, our lady's car would weigh 3 lb. and be rated at one-quarter horse-power. There are many matters of curiosity to be learned about those pretty motors in the Inventory. Thus the Rolls-Royce model weighs 4 lb. and its

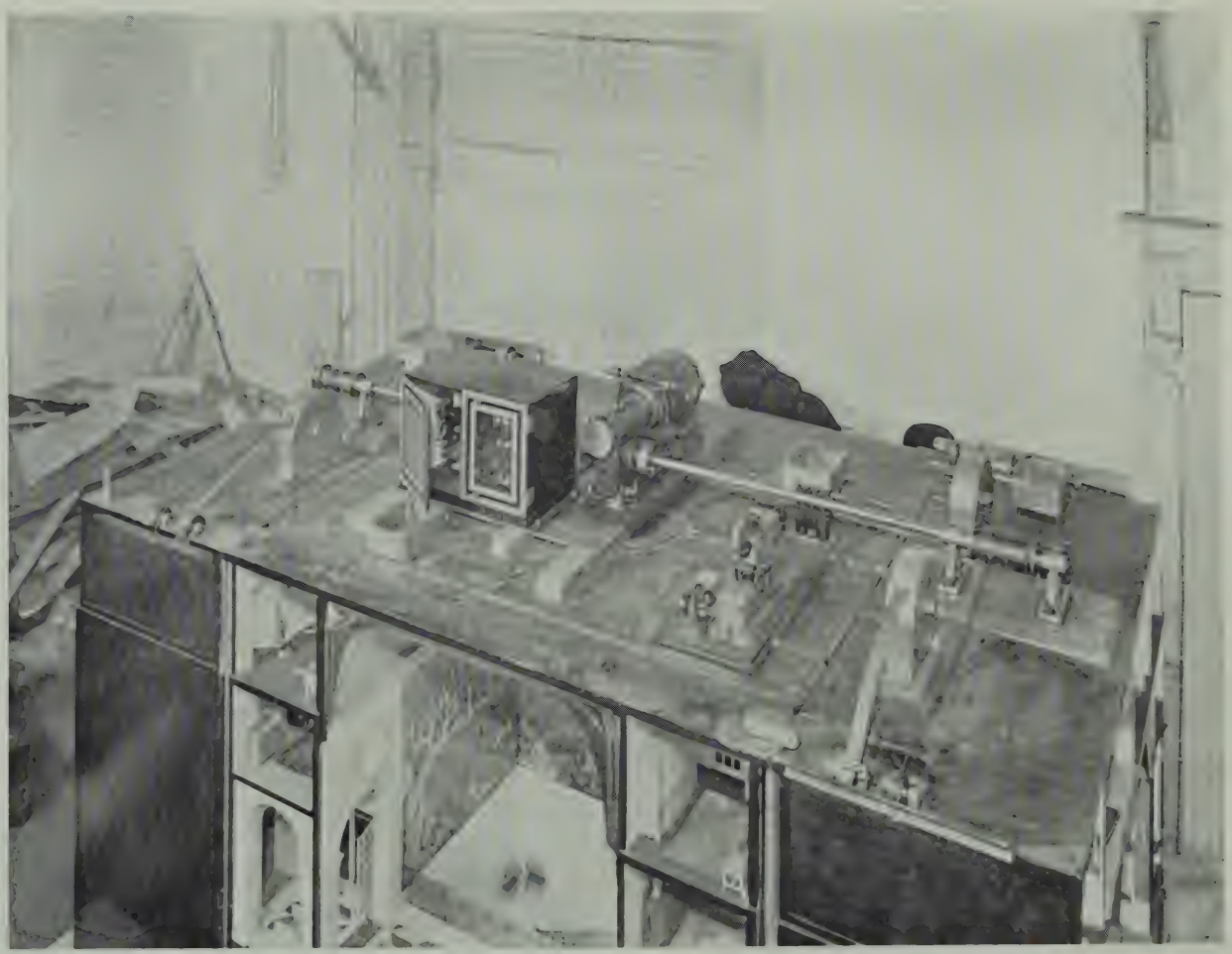
prototype of 50 h.p. weighs 5,200 lb. This is sufficiently near the calculated ratio to show the great accuracy of construction in the model, if, indeed, that were not obvious to the most casual observer. The Sunbeam car corresponds to a 24–60 h.p. open car of 1922 for four persons, and it has brakes on the front wheels as well as the back, so that it can be safely slowed down from very high speeds. The weight is 3 lb. 14 oz. (as against 3,700 lb. of the original). The number of firms and people who worked at and presented the detail parts of these models is remarkably great, as the Inventory shows.

As evidence of the musical enthusiasm of the Dollomites we find two pianos in addition to the gramophone which was mentioned above, and we are led to ask ourselves how far the Dollomites will in fact enjoy these instruments. The reason for this query is that the voices of the Dollomites themselves are most unlikely to be just like ours, though it is not so easy to make a correct surmise as to what their voices will sound like. The Dollomite has strong muscles, we know, and possibly can stretch his vocal chords as much proportionately as we do. If so, the pitch of his voice apart from resonances will be desperately high (say, 6,000 to 8,000 vibrations per second) for the main elements of speech or song: it may even be so high that, like the calls of some animals, we humans could not hear it—indeed, even if we consider the effect of the resonance in the cavities of their little mouths they would only appear to be whispering. Sir Richard Paget, who is an authority on such experiments and has assisted me here, tells me that in this whispering, which is mainly due to the resonances set up in their mouths and throats, they could not convey to us the intonation and the inflections of their speech. Hence a human eavesdropper would find his listening-in to be very monotonous and quite different from the impressions of fairy noises that we may have gathered from Grieg's "Dance of the Gnomes" or other fairy fantasies of our musicians. Indeed, if the Dollomite uses an air pressure pro-



THE LANCHESTER CAR

STANDING ON THE BONNET OF A FULL-SIZED 40 H.P. CAR



THE TOP OF THE DOLLS' HOUSE

SHOWING THE LIFTING MACHINERY AND THE MOTORS FOR THE ELECTRIC LIFTS: THE FORMER CONSISTS OF AN ELECTRIC MOTOR, WITH WORM GEARING ACTUATING A CRANK SHAFT TO WHICH ARE ATTACHED THE WIRE ROPES FOR RAISING AND LOWERING THE OUTER WALLS OF THE HOUSE

portional to ours, his smaller vocal organs set up sibilants which would mask and drown the vowel quality, and if he does not keep up the air pressure, we shall, I fear, hear next to nothing.

I have assumed above that these people's ears, which must be most beautiful and dainty things to look at, are internally adjusted to hear their own voices, rather than adapted to listen to ours, and consequently the gramophone will be a cause of wonderment and curiosity to them rather than a reproducer of anything they will call speech or song.

There is just another possibility which is worth considering before we dismiss this interesting question. If the Dollomite does not stretch his vocal chord to the same extent as we do, but relaxes it greatly, a view not impossible when we consider how delicate and fine the larynx must be, he might get his notes down to about twelve times higher than ours, and a Dollomite possessed of what he might call a full-bodied bass voice would be just audible to us as a high squeak, while a treble voice would sound like the very high whistle which we make in pronouncing continuously the consonant "S." His attempts to convey such letters as S, F or Th, would result in no sound at all that a man can hear. They would be much too high. Ears adapted to note and understand such sounds would not, perhaps, appreciate as music the sounds from their model piano, for a one-twelfth scale piano gives very high tinkling notes even to human ears.

The several pretty clocks in the Queen's Dolls' House no doubt serve the same purpose to the Dollomites as do our own watches—but there is a difference, possibly a significant difference, in the value to them of what we call one minute, or one hour. Their lives, basing ourselves on analogy from small mammals, are probably much shorter than ours, and there is reason to expect that the appreciation of a delay, or time expended, is actually affected by the size of the person!

Though it is difficult to assert on what grounds precisely a dog, a mouse, or even a man who has no clock, appreciates any in-

terval of time, it has been plausibly referred to the constant iteration within his person of his heart-beats, combined with some instinctive and unconscious act of adding up the beats as they proceed. If the Dollomite resembles in this the other animals his heart-beat is much more rapid than ours. Have you ever held a sparrow or a mouse in your hand and noticed the rapid flutter of his pulse and breathing? No doubt there is an exaggeration of the quick beating due to fear, but biologists tell us that the smaller the animal the faster is the normal heart-beat—and this is natural enough in some ways for the Dollomite. His muscles, as I have before indicated, are extremely strong and the heart is just a muscle with a heavy job to do in circulating his blood. His strong muscle should be able to do the work more quickly, but it would be far too risky to say "12 times as fast as ours." His veins and arteries are one-twelfth as long, it is true, but on the other hand they are very small indeed, and the resistance of such small tubes to the flow of a normal viscous fluid like blood is very considerable—and retards the flow. Even if a Dollomite's pulse were only twice ours, the day would on certain assumptions appear twice as long—he will be quite likely to want six meals a day—and if a young gallant has a tryst with his fairy sweetheart and keeps her waiting a minute she will probably be twice as much put out as our ladies are. In this general way I surmise that they will consider that the hour needs a finer subdivision than sixty minutes—say 120 micro-minutes. I hope their eyesight will keep pace with the need for reading these finer graduations.

One of the earliest things which the châtelaine of the Queen's Dolls' House did on getting into possession was to turn on the electric light. We may be sure she was entranced at the visions revealed to her, but also she was severely tried by the glare. "This house is very much overlighted," she said to her Major Domo, and she was right.

Anyone who looks with understanding into the detail work

THE ROLLS ROYCE CAR

STANDING ON THE TYRE OF A NORMAL SIZED CAR

of the adornment of the Queen's Dolls' House may very well be enthralled by the delicacy and beauty of the miniature reproductions of furniture, fittings and works of art, and welcome the fact that they are sufficiently well lit to be easily examined. But if we try to regard the electric lights with which the house is equipped from the point of view of its inhabitants, we shall probably not realise at once what a dazzling effect so great an illumination must produce upon the Dollomites themselves.

Actually, if the amount of light from any one lamp were one-twelfth of the light of the corresponding lamp which we will suppose sufficient for full scale, then the fairy creature will find itself 12 times over-illuminated. When a scene is over-illuminated it generally acquires a certain theatrical effect, as though it were lit to be looked at, rather than to facilitate the good seeing of those who form part of the scene. This is no reproach to the Queen's Dolls' House lighting, for is it not precisely that it may be seen *from without* that this illumination is provided?

Still, I like to keep in mind the point of view of the Dollomite himself; and if he were to look up after reading his newspaper and get the full light in his eyes, he would assuredly speak critically of the glare—even though the human being who looks into the house from outside would be unconscious of any excess.

This requires a word of explanation, since some of my readers may be critical of the bare statement.

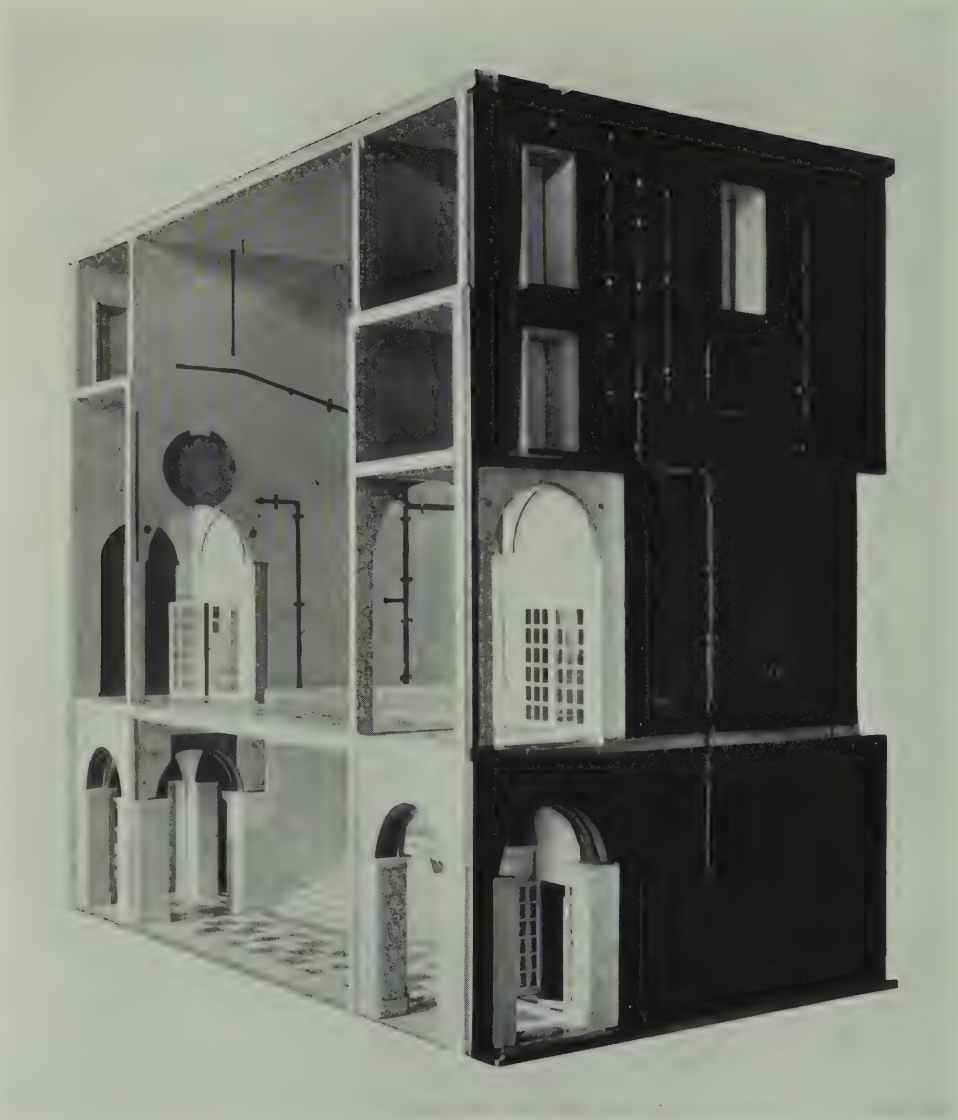
Suppose a room twelve feet cube, centrally lit by a 36 candle-power lamp, to be represented by a model 12-inch room with a three-candle lamp in the middle. On a shelf in the big room I see a book and read its title without taking it from the wall. I read easily and without fatigue from any glare, because at 6 feet away from the central light the illumination is one candle. But my poor little Dollomite counterpart has his book only half a foot away from a three candle-power lamp and the illumination on his book is 12 candles! Rather much to find no part of your room to which you can turn for a relief from this dazzle!

This is perhaps the place to draw attention to a future historico-scientific aspect of the Queen's Dolls' House. At some date, perhaps 2,000 years hence, an antiquary, the Lord Carnarvon of that era, may discover it forgotten among the lumber in a vault at Windsor, and the world will ring with his deductions as to an amazing and amusing treasury of information upon the strange habits, the science, the literature, the amusements, the arts and the manners of the twentieth century. He will multiply 12-fold the size of each detail, the chairs, the cabinets, the locks, the doors, the pictures, the lifts, the cooking range, the electric wires and chandeliers, and he will say, "Thus and thus were the Victorians, the Edwardians and the Georgians equipped." Broadly he will be right, but in detail he must be guarded.

Let us take as an example the electric wires; who shall say what voltage should be used to maintain the one-twelfth scale? Such a question brings us dangerously near to the problem of Einstein, with which this is no place to deal. Actually the voltage is not one-twelfth of the usual 200 volts, but just 4 volts, for simply practical reasons of safety from fire, and in order to utilise a little glow lamp which would not have too short a life. In consequence the size of the wires is much larger than in proportion, and the thickness of insulation is also greater for mechanical reasons than one-twelfth of the insulation in our homes and public buildings.

No doubt but that the antiquary will have sense enough to make such allowances, but it is testimony to the extreme care with which the one-twelfth scale has been adhered to that it is advisable to mention such departures.

Even the switches, which are fixed in position from the back of the walls, could not, as may well be imagined, be made to occupy the one sixty-fourth part of one cubic inch, not at least by human hands, nor if they were so made could they be expected to last a week. Wall plugs likewise depart from normal, and to keep the small size are made of a small brass tube into



THE HOUSE IN THE MAKING

SHOWING THE HALL SECTION WITH ELECTRIC WIRING

which is fitted an insulating lining with a hollow brass stud in the centre, making a very neat concentric wall plug connected by soldering to the electric wires at the back of the wall.

Many more peculiarities of this kind are noted in the inventory, a not unimportant one being the imitation lamps in the candelabra, where the size of working lamps would be altogether out of scale. Some appreciation of the difficulties of reduction may be gleaned from the fact that the weight of the electric installation, which in a life-size similar house would be nearly a ton and three-quarters, here is only 87½ lb., while a pendant is a quarter of an ounce instead of 2 lb. 12 oz.

Perhaps one of the great distinguishing features which separate model work from full scale is that model making of this kind is not and never has been industrialised. It is an art or a hobby, each production is unique, and whether or not it is paid for, it is made for love and inspired by enthusiasm. Perhaps this is why it commands an admiration and makes an appeal for which it is difficult to find a logical basis.