FURTHER RESEARCH INTO THE CONSTRUCTION OF MAIL GARMENTS

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By E. MARTIN BURGESS

In a previous article[1] the writer described the technique used by armourers of the past to make mail. Very little is known about the craftsmen who made it. It is not yet possible to date pieces of mail with the same degree of accuracy with which pieces of plate armour can be dated. There are several reasons for this lack of knowledge. In the first place mail is a structure which does not lend itself to the use of armourer's marks, and though pieces are marked in one way and another, experts are so far unable to trace them to their sources. Secondly, a mail garment is not necessarily restricted to one known wearer, but because of its stretching and contracting qualitieswill fit almost anyone reasonably well. Thirdly, at the time when mail-making was at its height the armourer's craft had not developed to the same extent and had not yet acquired the social and decorative importance which it was to have in later years. Thus the mail-maker was more obscure and his work had no characteristic sculptural quality by which it could be recognized. On the other hand, in the early days of armour, mail garments were few and very valuable with the result that they frequently changed hands, the stretching quality permitting their use by different owners. Lastly, mail suffers from rust because it exposes a vast surface of metal to the air. When it is worn the constant friction between one ring and another wears it out comparitively quickly even if it is never permitted to get rusted. For this reason the rings in mail shirts are often thinner round the hips than on shoulders, chest, or back. Most of the early mail has been destroyed by wear and time and only fragments remain. It is not possible to say with certainty to what type of garment these fragments once belonged.

It is small wonder then that so little is known about mail as compared with plate armour, but it is to be hoped that future research will uncover its secrets and aid the detection of fakes and modern reproductions. The aim of research is primarily to fix dates, localities, and makers' names on existing pieces of mail and, at the same time, to find out more about their construction.

The approach to the problem has been from the practical and craft side, and now that the method of constructing the rings is known, it is possible to aboserve how one garment differs from another of its own kind. Two equally well-made shirts or standing collars or pairs of sleeves will be quite different in construction. It is necessary to abserve this variation very minutely and to try to acsertain why the difference exists. The truth is that unconsciously any craftsman leaves his mark on his work. It is like his own work and like the work of no other craftsman.

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[1] *Antiq. Journ.*, vol. xxxiii (1953), pp. 28-55.

The writer wishes to acknowledge his great to Sir James Mann, P.S.A., and to the staffs of the Wallace Collection and the Armouries of the Tower of London, for without their help and cooperation the research embodied in this and his previous paper would have been impossible.

The difference between two mail garments of the same type can be grouped under the structure of othe rings themselves; their wire thickness, their rivets, their diameter, their roundness, and under the way in which they are linked together. It must be understood that inorder to obtain useful information these two factors, the rings and their linking, must not only be observed, but a way found to record the observations accurately. Pieces of mail which are scattered all over the world must be compared at a distance, not against each other, but against these very accurately recorded facts. In short, each piece of mail must be carefully analysed and all the analyses must be carried out on the same lines, using the same standards and with the same end in view. Vast masses of data will have to be recorded before results can be obtained, but sooner or later it should be possible to say with certainty that two or more garments are by the hand of the same craftsman, a product of the same time or locality.

To achieve this end two questions must be asked and answered. What factors make one mail ring like itself and unlike a mail ring in another garment? What factors make a mail shirt or standing collar or sleeve, etc., like itself and unlike any other mail shirt, standing collar, or sleeve?

The first step in the analysis of a garment is the minute examination of the individual rings. There may be many different types of rings in the garment; the rings of the main construction, brass for borders and decorations, smaller rings for strength around the necks of shirts and capes, small whole rings punched from a sheet often used to contract the necks of shirts and capes, rings used for repair, patches of other mail used for repair. Each type of ring in a garment must be examined and the observations recorded.

The first subject for examination is the wire fromwhich the rings are made. Its cross-section must be observed and recorded and, if there are any drawplate marks, it must be ascertained whether they are the product of a smooth drawplate or of a rough swage block. Perfectly round wire is the product of a true drawplate. Wire-drawing was described in the previous article (loc. cit., pp. 48-49).

The next step is to measure the diameter of the wire. This can only be done conveniently in one direction, at right angles to the plane of the ring. Measurements are best made with a micrometer and the results given in thousandths of an inch. As the wire in different rings of the same garment sometimes varies only by about five-thousandths of an inch it is not enough to state the wire thickness to the nearest thirty-second or even sixty-fourth of an inch as has been thought sufficient hitherto. Several rings of each kind must be measured for wire thickness and the results averaged, the average and the variation being recorded. Modern wire shows up at once under this test; the drawplate marks are smooth and almost invisible and the wire is perfectly circular and accurate. Repairs in modern wire to a shirt in the Wallace Collection (no. 335) have a wire accuracy of 5 thousandths of an inch, even though the wire has been rusted. It must be remembered, when wire is being measured, that only pieces of wire flat in one plane at least give accurate results. Bends, other than the curve of the ring, give a greater thickness for that particular ring and therefore care must be taken to select rings which are quite flat.

The diameter of the rings must now be measured and the results recorded in the

same manner as for the wire. The rings, because of the riveting, will never be quite circular; measurements must therfore be made across the ring in one direction only, a diameter parallel to the rivet joint. Care must be taken to see that the ring is not gripped by the micrometer at an angle or it will not record its diameter correctly.

Last and most important is the study of the rivet joint, if the ring is riveted, or the butt, if it is butted. Butted rings in European mail are almost always restoations and, if they are, this can be conclusively proved by testing the wire diameter variation with the micrometer. Inspect the butts to see if they have been sawn, or cut with wire cutters. Cutters willleave a depression each side where the baldes have clipped the wire. A saw often leaves a burr where the last piece of metal has been broken by the pressure and not cut. The sawn surfaces will also show marks of a saw unless they have been filed smooth.

If the ring is riveted, the type of rivet must be recorded and drawings made of the formation round it both back and front. There is often a 'water-shed' formation round the rivet head. Sometimes the 'water-shed' shows itself on the back as well. The head of the rivet or the area round it may have some type of 'tool-deformity' and, if this is repeated over several rings, it is worth recording. If the hard steel tools which closed the rivet or swaged out the rivet joint had certain forms or marks on them, these would be repeated over and over again. If there are armourers' marks, they are often introduced in this way, and are punched on every rivet head or tail. The shape of the back of the rivet is important. It is sometimes hard to see especially if the mail has been much rusted. The rivets are usually iron, but sometimes they are copper. No doubt the latter was softer to close. To record an exact impression of the rivet joints it is best to make casts of them in plaster of Paris.

When the rings have been thoroughly examined the garment can be analysed as a whole. A general description will put the various parts into their proper perspective and then the real analysis can be started.

Before the technique for analysis is described it would be best to explain the way in which mail garments are built up. The first necessity is a diagrammatic representation of mail to show its construction. The one used by the writer looks nothing like real mail, but the same formation can be reconstructed in butted rings from the diagram. The diagram must clearly show which rings link into each other and where the rows are. Pl. xxiii, *a* shows a butted reconstruction of a piece of mail of the usual European formation; one ring passes through four other rings. In this piece there are no complications and fig. 1 shows the same construction in diagrammatic form. The rings in fig. 1 are represented by the circles and are seen conveniently spaced apart. The rings which are linked together are joined by lines and the row lines are drawn, dotted, right through the rows. The mail is always examined from the outside, that is, the side on which the rivet heads show.

Repairers often patch with fragments of old mail and make the mistake of putting the rivet heads on the inside. In all mail the rivet heads face one way and in use they must have faced the outside. There would be considerable wear on any garment worn under the mail and no doubt the armourer cut down the friction as much as possible. This to some extent explains the trinagular rivets with their very smooth backs. No doubt mistakes were made, shirts were worn inside out, mail capes had

their clasps fixed on the inside, but on the whole it is safe to say that the trinagular rivet is intended to be worn with its large and almost invisible back on the inside. If this argument does not seem conclusive, the doubter has only to run his hand

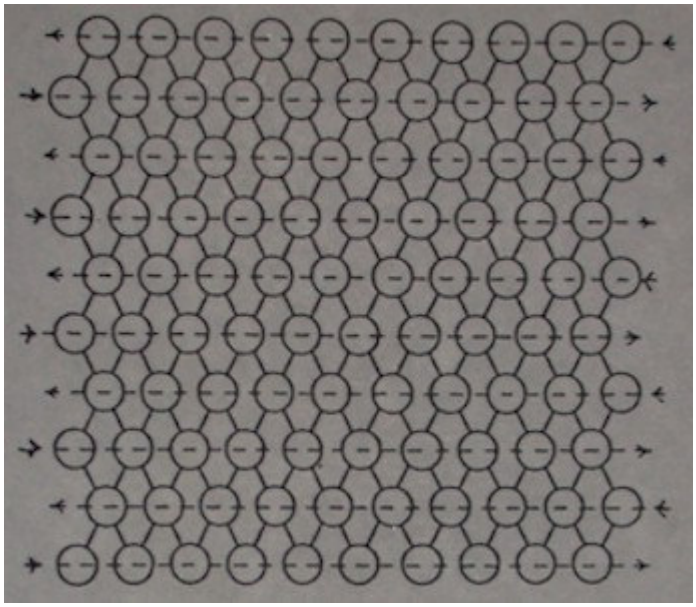


Fig. 1.

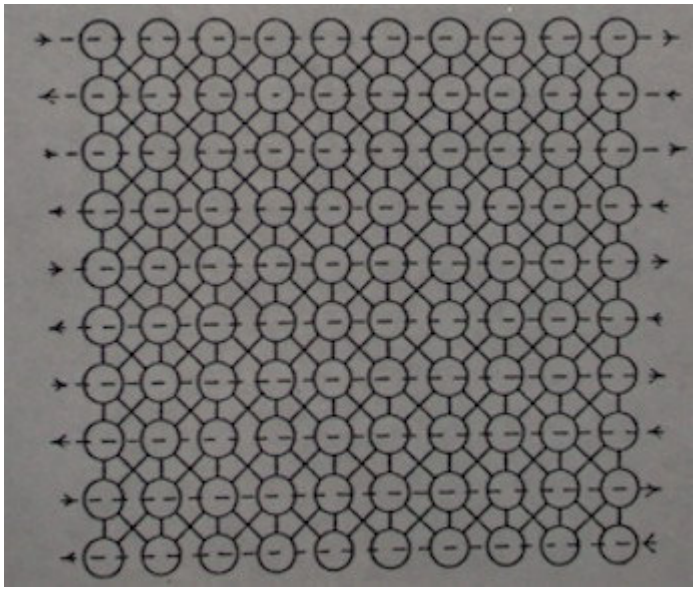


Fig. 2.

over some mail, preferably of the close-textured variety, and notice how smooth the back is and how rough the front; or to look at the superb camail on the 'Churburg Bascinet' now in the Armouries of the Tower of London and try to imagine the rivet heads turned inwards.

The first row of rings in pl. xxiii, *a* and fig. 1 slope to the left, the second to the right. If desired this can be shown by arrows on the row lines. This mail is of ordinary four-in-one European construction; pl. xxiii, *b* is a butted six-in-one garment, but it is shown here to demostrate how the comples tight structure is made simple by a diagram (fig. 2).

If a garment is to have shape and form, it must be expanded in some places and contracted in others. In mail the shaping is done in two ways or adaptions of these ways. Lines of rings can be joined at right angles to each other as shown in fig.3.

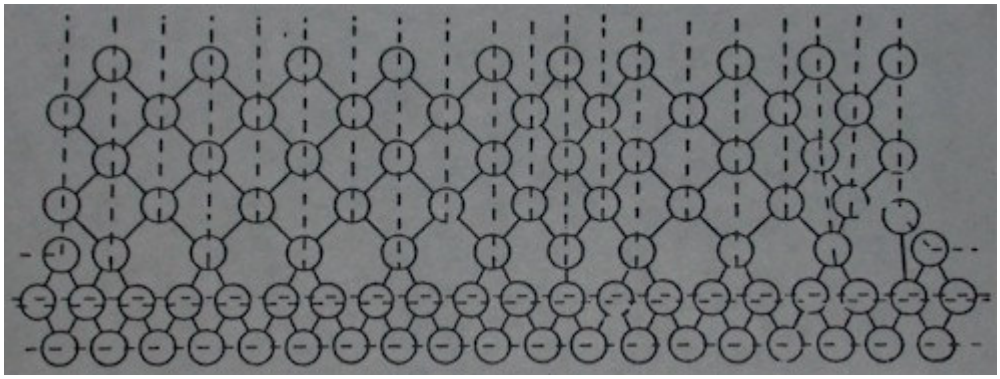


Fig. 3.

This diagram is taken from the armpit of a shirt (no. 335) in the Wallace Collection. Notice that the three-dimensional shape of this section of the shirt has distorted the row lines in the diagram, but it would still be possible to build a butted reproduction from it.

The second and much more subtle way of giving the garment shape is to increase or decrease rings, either singly or in formations and groups following some preconceived plan as done in knitting. Fig. 4 shows a ring added or subtracted depending on which way the diagram is held/ This ring, only linked into three others, is shaded. It is convenient for want of a ready-made term to call this an ‘idel’ ring because it hangs loosely out of the mail structure when the garment is hung up. If more rings result below the idle ring, it is an ‘idle increase’; if less it is an ‘idle decrease’, and as a rule the shape of the garment indicates which of the two it is because garments have an easily defined top and bottom.

An idle ring by itself in a piece of mail is hard to see, but usually shows itself by its idleappearance, hanging out of the structures. Pl. xxiii, *c* shows a piece of butted mail with one idle ring.

The mail maker, working on a half-finished shirt, would think in terms of idle rings, or increases or decreases, in the correct places; not in terms of ‘pieces of mail put in to expand the structure’. This is why it is a pity the term ‘gusset’ has come to be used to describe these V-shaped formations in mail garments. The word ‘gusset’ is perfectly correct for describing lines of increased or decreased idle rings

where these rings are so close to each other that they give an obvious change of direction to the rows. Most increases or decreases, however, are not made in this way but are carried out invisibly by scattered idle rings. It would be much better to abandon the term ‘gusset’ as applied to these visible formations and to approach the subject from the ‘idle rings’ point of view which covers all expansions and contractions, both those which are readily apparent and those which are hidden. To say ‘gusset’ is also to regard mail as a cloth to be pulled apart and joined up at will

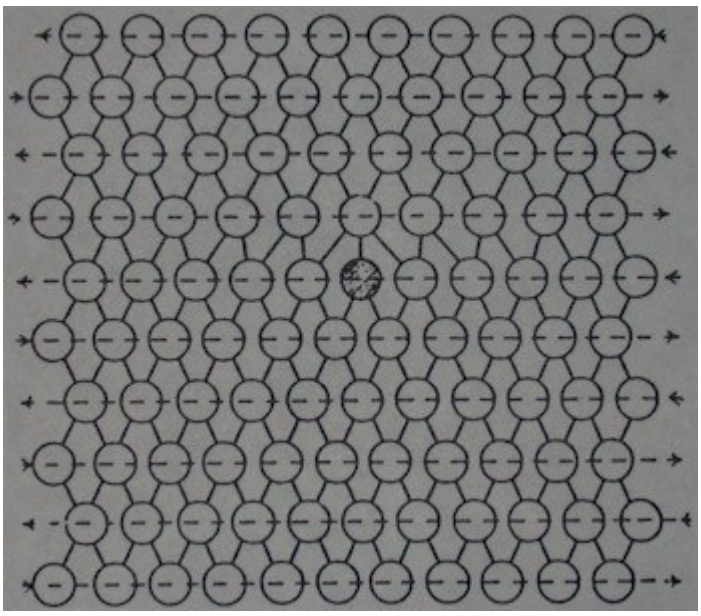
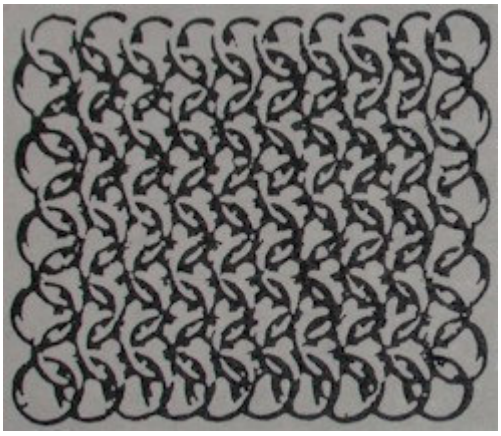


Fig. 4.

and it is doubtful if this was ever done. Mail was built up link by link, a row at a time, like knitting, and to give it shape idle rings were put in to get the required formation. The best piece of invisible expansion known to the writer is the opening out on the camail of the ‘Churburg Bascinet’ previously mentioned. The expansion over the shoulders is produced by scattered idle rings which are far enough from each other to be very hard to see.

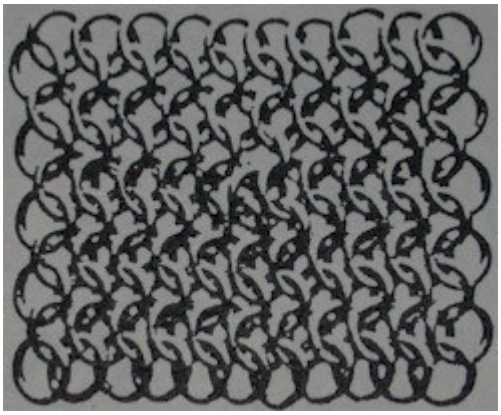
Idle rings can be used to decrease the number of rings in a row or the number of rows. When rows are reduced, two rows are cut out together and either one or two idle rings result, depending on the construction. The writer has found both these constructions in shirts and both in the same shirt. One produces a hole in the structure, and the other tends to produce a knot. The type with the knot has one idle ring and is found, in a shirt, in the row reductions on the rump. The type with the hole is found in the row reductions to shape the sleeve and is situated on the underside. Here a knot would bunch and cause discomfort but a small hole would not endanger the wearer. Pl. xxiii, *d* is a butted reconstruction of the knot type and fig. 5 is a diagram of it. Pl. xxiii, *e* is abutted reconstruction of the type with the hole and fig. 6 is a diagram of it. Note the number of idle rings which result.

In mail garments these patterns of idle rings are often very complex and they are often, especially in mail of good quality, perfectly symmetrical, that is, the formation

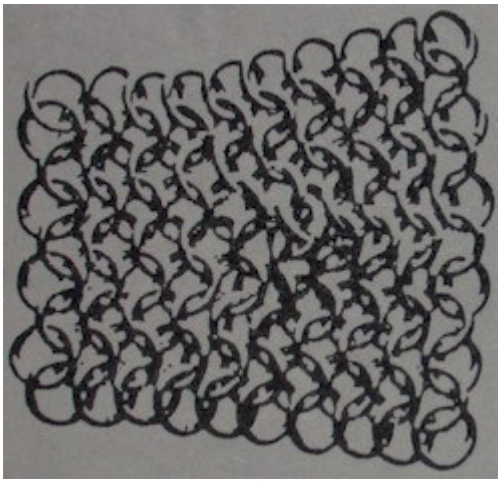


a

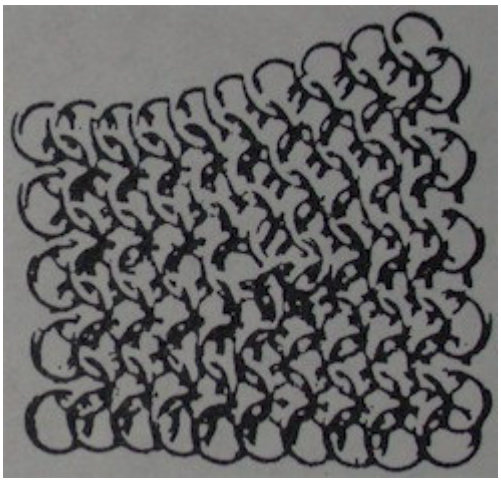
b



c



d



e

Samples of butted mail showing various constructions.

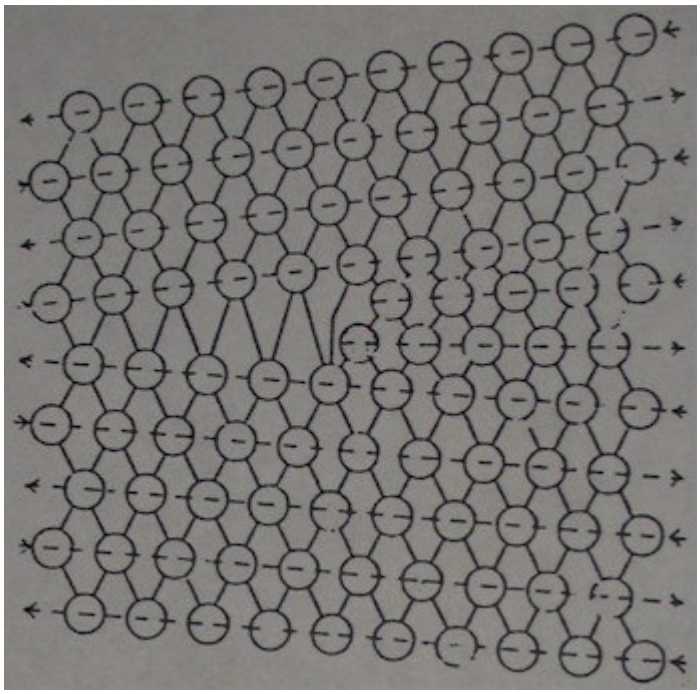


Fig. 5.

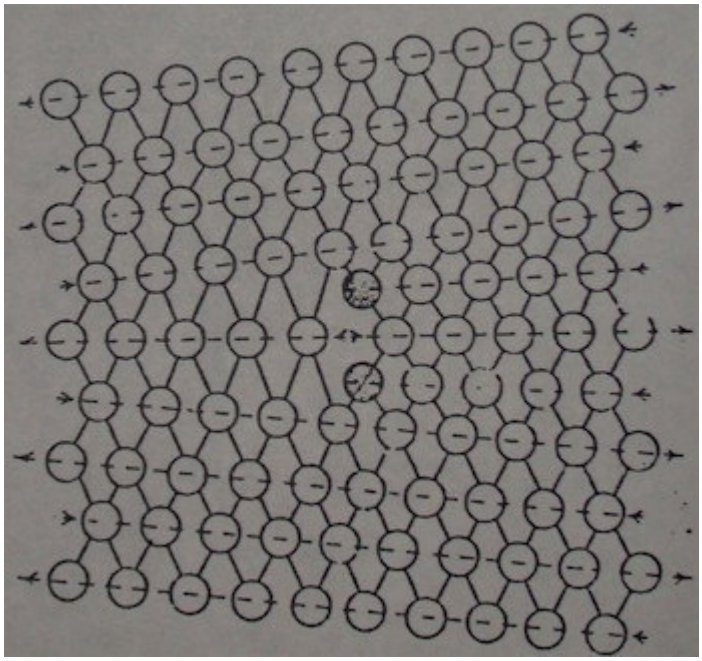


Fig. 6.

on the left is the same as that on the right. There is a reason for each increase and decrease and the craftsman does not often make a mistake even when an expansion or contraction is by scattered idle rings. It is almost certain that he had no written pattern to work from but carried a ‘theme’ pattern in his head for each type of

garment. For different sizes he would probably make variations on this ‘theme’. The ‘themes’ might be passed from one generation to another; exist in one locality; or they might indicate an age in the development of the craft. This is, however pruely specualtive. Time and research alone will show the conexion between one pattern and another. The great importance of these patterns, however, is that existing mail garments can be compared with one another. An analysis of the garments is all that is required.

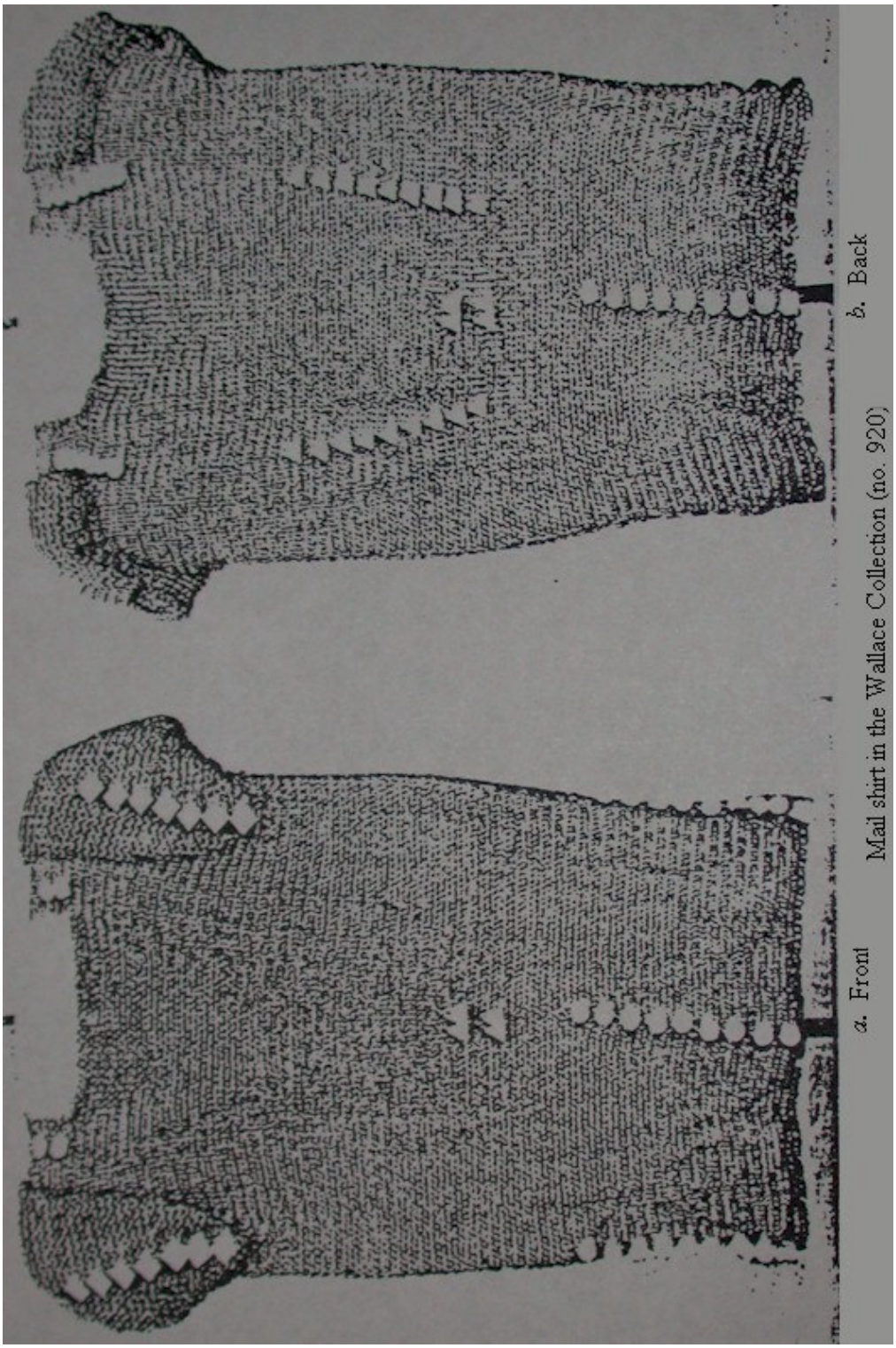
The analysis of a mail garment is not difficult, but it takes time and patience. A shirt is one of the most complicated garments to analyse so it will be best to describe the method used for that. After all the types of rings have been examined, as described above, the shirt must be hung up. One idle ring will be visible at a time, so in order to grasp the whole pattern each idle ring has to be marked with a tag. The writer has found small circular plastic tags of different colours to be the best.

The first step is to mark off the area to be analysed. The body of the shirt should be done first. The number of rings in the bottom row are counted and the number of rings in the first row under the armpits. If the bottom row of the shirt is rather ragged it is best to count a row a little way from the bottom. The counting is made easier if a marker is placed through every tenth ring. The counting of rings must be exact or much needless work will result. The positions of the ‘counting’ rows must be recorded, their distance apart and from the bottom of the shirt. There will almost always be more rings in the bottom ‘counting’ row because some additions will have been made. Increasing and decreasing idle rings in this section are then found and marked, until the numbers balance, showing that all idle rings have been found. The markers will have built themselves up into regular symmetrical patterns. The position and number of idle rings must be accurately recorded. Their height can be given by stating how many rows they are from the top or bottom ‘counting’ row, and the slant of the lines of idle rings given, by stating how many rings are between the top and bottom idle rings on each side.

The rest of the shirt can be tackled in any order. Special note must be made of the structure under the arms where they join the body. Here the lines of rings are joined at right angles to eachother and a diagram must be made as there is no convenient way of putting the structure into words. A similar structure is often found around the neck, as three or four lines of rings from the back are sometimes made to run over the shoulders to give an edging to the neck. Over the shoulders they will naturally run at right angles to the other lines of rings running down the arms. This structure must also be recorded diagrammatically.

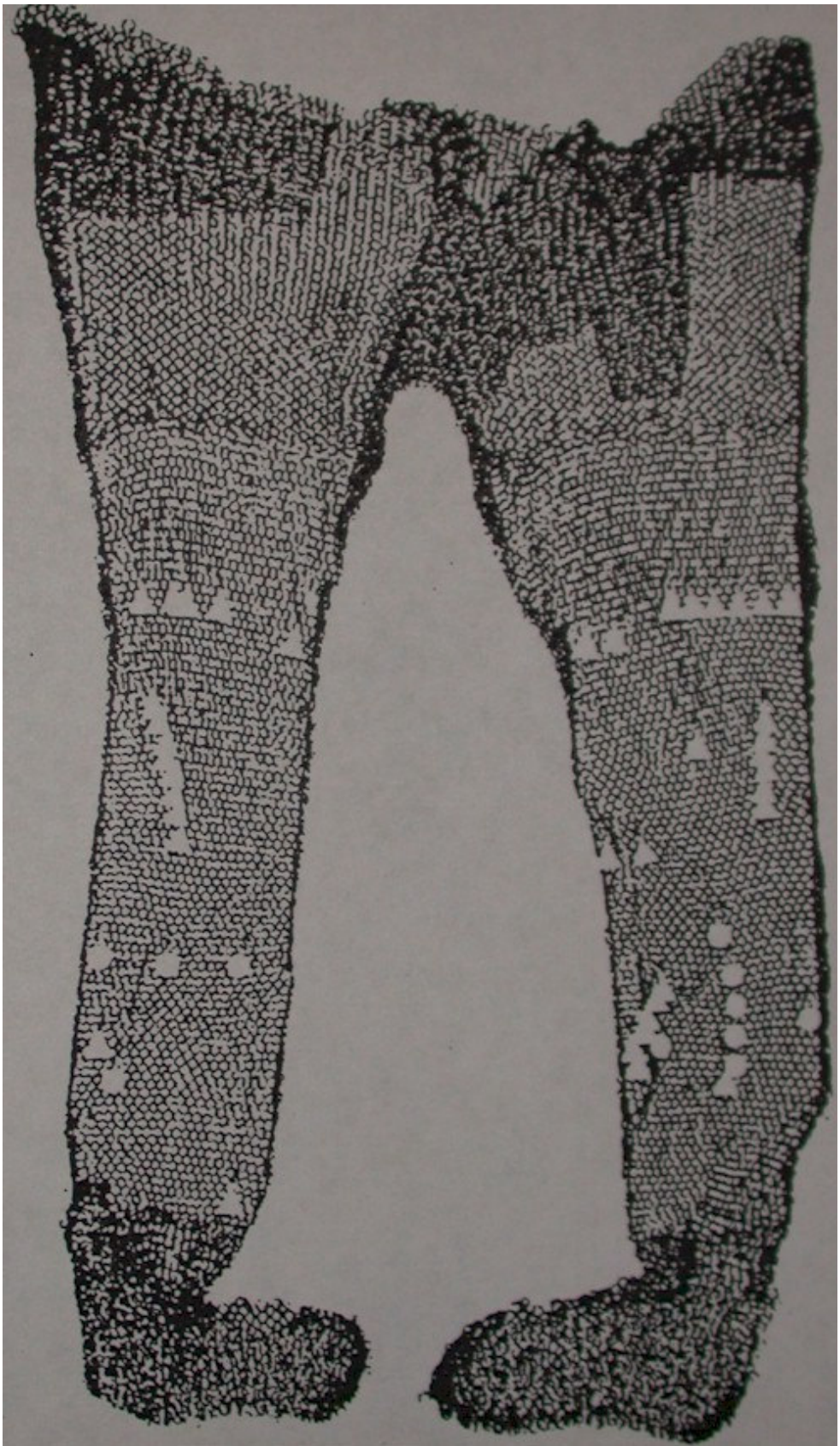
A line of increase idle rings often runs from each shoulder over the shoulder blades. This is probably because more room is required in the back of a shirt to permit free movement when the arms and shoulders are hunched forward. If there is any doubt as to which is the front and which is the back of a shirt, as sometimes happens, this construction will indicate back and front.

The sleeves can be analysed in the same manner as the body, but the lines of rings will be along the sleeves and not round them. Thus reductions in the sleeve diameter will be row reductions and not ring reductions. The method for row reductions has been described above. If the sleeves are of wrist length there will



a. Front b. Back

Mail shirt in the Wallace Collection (no. 920)



Pair of chausses in the Wallace Collection (no. 336)

often be a set of idle rings on the inside of the elbow to give the sleeve a bend and prevent bunching when the arm is bent. These will be decreasing idle rings.

Every mail garment can be analysed in this way, but the analysis will be of no use unless it is absolutely accurate. The writer has found circular plastic markers of different colours, provided with wire hooks, suitable for research. If, however white markers of different shapes are used, circles for increases, triangles for decreases, squares for row reductions, photographs can be made of the garment with the markers in place. It may take several hours to get the markers in their correct positions, so a photograph of the resulting patterns is helpful for purposes of comparison with other similar garments. Pl. xxiv is a photograph of a shirt (no. 920 in the Wallace Collection) with the markers in position. The construction of this shirt is straightforward and has been carried out with great precision. The shirt is four rows longer at the back than at the front, and these four rows are takenout at the sides in pairs, with a construction of the knot type producing one idle ring for each pair. Each pair is marked with a white square hung by the corner.

The expansion for the hips is produced by four vertical lines of idle rings, one on each side, and one in the centre of the front and back. There is one idle ring to every four rows.

Reductions for the waist are carried out in two sets of four, marked by white triangles, in the centre of the front and back and by two sloping lines of idle rings on the back. Each of these two lines contains nine idle rings, one to every four rows, and this compensates for the shoulder-blade expansion which runs over the shoulders from front to back. This shoulder-blade expansion consists of nine idle rings on each shoulder, one to every other row.

The sleeves were photographed folded back over the shoulders to expose the row reductions reducing the diameter of the sleeves. These reductions each produce two idle rings, forming a slight hole, and cut out two rows together. They are shown by squares hung by a corner and are in a line on the underside of the arms. Each sleeve is reduced in diameter by fourteen rows.

This shirt was chosen as an example, not only because of its pecise an logical construction and its excellent state of preservation, but because it bears what is probably an armourer's mark. This is in the form of a stamped brass ring in the centre of the front of the neck. It is desirable that the first mail articles to receive attention should be those about which something relating to their history is already known.

The photographs do not record the exact numerical positions of the idle rings in relation to the counting rows nor do they record the formations round the neck or in the armpit, so full notes and diagrams still have to be made. The photograph does, however, explain the notes to someone who has not actually analysed that particular piece of mail.

The analysis of mail also makes fakes or deceitful alterations instantly detectable. Now that the method of making mail is known it would be possible to construct whole garments and pass them off as medieval, but to construct every ring in such a garment and link the rings together would be a worthless occupation since the cost of the labour would far exceed the value of the finished article.

In the past genuine pieces of mail were altered to make them more valuable. Pl. xxv shows a pair of chausses which are in the Wallace Collection (no. 336). They are seamed up the back of the legs with butted rings, but this might have been other mail converted with intent to deceive or a pair of genuine chausses split up the back and joined together again at a later date to restore them as far as possible to their original state. Markers were placed in the chausses, and it is obvious from the photograph that they have never beengenuine chausses because the construction bears no relation to their shape. It is impossible to make up old mail into rare garments and escape detection, because some of the structure from the original garment will remain. In the opinion of the writer these chausses (no. 336 in the Wallace Collection) have been made from a shirt which has been cut up the centre of the chest and back, and each piece separately joned up with butted rings. The alteration has, to a large extent, destroyed the symmetry of the pattern.

The method of analysis which has been described does not tell us very much about the date or origin of a piece of mail. The research is not sufficiently advanced and not enough data have been collected, as yet, to enable pieces to be related to each other. The analysis gives a mail garment an individuality which has not previously been recorded and this will enable garments to be compared constructionally. This analysis is, however, of little practical value or interest, except perhaps to the technician, unless by comparison more can be learned of the history of pieces.

Craftsmen do not use patterns and techniques at random; they tend to adhere to the methods which they have been taught. This would be especially true of a craft so ancient and repetitive as mail-making. It is the writer's belief that the patterns found in mail have a very real historical, and perhaps goegraphical, significance. Investigation into these patterns may be the road to further knowledge of a craft which probably died out within the last century, after a history covering three thousand years.