AN INVESTIGATION INTO THE RELIABILITY OF THE FUNKENSTEIN TEST

by

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INTRODUCTION.

Since the historic work of W.B.CANNON (9) there has been an expanding interest in the physiological relationship between emotion, behaviour, and mental illness, much of which is concerned with neuro-endocrine and autonomic activity.

The Funkenstein Test is a test of autonomic function in which the patient's systolic blood pressure response to intravenous adrenaline and intramuscular methacholine hydrochloride is recorded.

The test is claimed to have established a relationship between autonomic reactivity, mental illness, and the effects of electro-shock therapy.

Those patients with a large and sustained fall in systolic blood pressure following intramuscular methacholine hydrochloride and having difficulty in establishing homeostasis are alleged to be more likely to respond to electro-shock therapy than those who achieve homeostasis rapidly.

This is said to be true regardless of diagnostic categories. It is postulated by Funkenstein that there is a parallel between psychological and physiological change, in that when patients showing this diminished response undergo improvement or recovery the psychological changes are accompanied by a corresponding return to a normal systolic blood pressure response to intramuscular methacholine hydrochloride.

This parallel relationship is observed when the clinical improvement is achieved by various treatments or when the patient undergoes spontaneous recovery.

The elucidation of the problem of post-hypothalamic function and its relation to mental disorders, and the better understanding of the effect of physical treatment, and the numerous drug therapies now being introduced, make those propositions ones of great theoretical and practical interest.

It is suggested that autonomic imbalance plays an important, if not essential, part in the formation of functional psychosis but that the same autonomic dysfunction can occur in different disease entities. The autonomic disturbance does not determine the form of the psychosis.

If the test is an accurate predictor of the therapeutic value of electro-shock therapy it will help to establish this form of treatment on a sound physiological basis and remove it from its present empirical position.

It is necessary to clarify the perplexity of the present position with regard to the administration of the various physical and drug therapies and there is a great need to establish valid objective aids to clinical diagnosis in psychiatry.

At present the predictive power of the Funkenstein Test is thought to be low, and it is of considerable interest to examine the reasons for this.

The validity of the test cannot exceed its reliability so that the most important problem becomes one of assessing reliability.

The test could, of course, have a high reliability as a test of nervous system reactivity without necessarily having a high validity as a prognosticator in electro-shock therapy.

It is proposed that this thesis should deal with the problem of reliability.

REVIEW OF LITERATURE. 1. On the Funkenstein Test.
2. On Reliability.

1. The sympathetic and parasympathetic divisions of the autonomic nervous system act synergistically in controlling the function of most of the visceral organs. Any disturbance in autonomic balance will result in some degree of visceral dysfunction. This was recognised by VON NOORDEN in 1892 when he described clinical conditions associated with vagal irritability and called them vagal neuroses.

In the year 1910 H. EPPINGER and L. HESS carried out an extensive statistical analysis of the effects of various drugs upon autonomic reactivity in humans and made a clear formulation of the concept of autonomic imbalance which is relevant to the understanding of psychosomatic and psychiatric disorders and their treatment at the present time. Those individuals who responded strongly to Pilocarpine and Atropine, and minimally to Adrenaline, were classified as vagotonic, and conversely those individuals who reacted strongly to Adrenaline but minimally to Pilocarpine and Atropine were classified as sympatheticotonic. They related this autonomic imbalance to the symptom formation in a number of diseases such as asthma and peptic

ulcer, which are now considered to be psychosomatic conditions.

A. KUNTZ (35) in a critical review of the work of Eppinger and Hess produced evidence to show that besides having individuals with sympatheticotonic and parasympatheticotonic dominance there are many instances of both heightened sympathetic and parasympathetic activity being related to symptom formation. He also demonstrated that some normal persons, having no clinical evidence of autonomic imbalance, show heightened response to both sympathomimetic and parasympathomimetic drugs.

M. A. WENGER (60, 62, 63 and 64) in making a statistical analysis of a number of autonomic variables in children and adults at rest, demonstrated that there is a number of autonomic patterns or profiles with the theoretical possibilities of sympathetic or parasympathetic dominance associated with either heightened or lowered total autonomic activity. The apparent dominance of one division over another may be phasic or chronic. He also showed that although mixed patterns occurred they had an individual specificity. He related autonomic states to psychological function, and was of the opinion that children with parasympathetic dominance were less excitable, less active, and less prone to fatigue, and were more patient and neater in appearance and behaviour than children with sympathetic dominance.

He considered that the basic autonomic pattern or profile of the individual was genetically determined, although subject to influence by environmental changes. At a later date M.A.WENGER (1957) described a pattern of autonomic activity at rest which was approximately twice as frequent in psychosomatic and psychoneurotic disorders as in normals.

In analysing the genetic factors in the autonomic nervous system H. JOST and L.W. SONTAG (34) have shown that the correlation of autonomic patterns is significantly higher in monozygotic twins than in siblings, who, in turn, have a significantly higher correlation than unrelated controls. They conclude that this is related to a familial distribution of psychosomatic disorders.

The principle of relative response specificity is supported by J.LACEY, D.E.BATEMAN, and R.VAN LEHN (36 and 37).

They examined a number of autonomic variables in 85 male students and found that in general they had a fixed pattern of autonomic variability in response to stress. Some of the students, however, appeared to vary haphazardly.

In investigating the homeostatic mechanism in the newborn, H.J.GROSSMAN and N.H.GREENBERG (31) concluded that individual differences in autonomic activity exist within a few hours of birth, but they note that homeostatic mechanisms vary widely between and within individual children.

R.GJESSING (30) made a notable contribution to our knowledge of metabolic changes associated with psychoses when he showed that the mental changes in periodic catatonic schizophrenia were closely related to changes in nitrogen retention and other metabolic upsets. He also showed that to some extent these changes could be corrected by giving thyroid extract, and this also produced symptomatic improvement.

In 1938 LINDEMAN and FINESINGER (38) investigated the effects of adrenaline and methacholine hydrochloride in states of

anxiety in psychoneurotics and showed that heightened anxiety was created by an injection of adrenaline.

In association with M.GREENBLATT, H.C.SOLOMONS and others, Funkenstein published a number of papers from 1948 onwards, giving the results of the measurement of autonomic activity by the adrenaline- methacholine hydrochloride test (the Funkenstein Test) in a large series of patients with various mental disorders and the important results inferred from their data. They recorded the systolic blood pressure responses to adrenaline and methacholine hydrochloride in graphical form and allocated the graphs to seven groups, as follows:-

Group 1 showed a marked reaction to adrenaline and a mild reaction to methacholine hydrochloride with a rapid return to, and rise above, normal.

Group 2 showed a marked reaction to adrenaline and a moderate reaction to methacholine hydrochloride, with rapid return to normal.

Group 3 showed a moderate reaction to adrenaline and a moderate reaction to methacholine hydrochloride, with a quick return to normal.

Group 4 showed a moderate reaction to adrenaline and a moderate reaction to methacholine hydrochloride, with a delayed rise back to, or above, normal.

Group 5 showed a mild reaction to adrenaline and a marked reaction to methacholine hydrochloride.

Group 6 showed a marked or moderate reaction to adrenaline with a marked reaction to methacholine Hydrochloride.

Group 7 is similar to Group 6 with the exception that during the course of the administration of methacholine hydrochloride the patient has a chill with shivering and excess noises, leading to the abandonment of the test.

They further sub-divide their patients according to the precipitation of the relief of anxiety by their administration of adrenaline and methacholine hydrochloride. When attempts are made to assess anxiety they can be highly unreliable, even when complex rating scales are used. Therefore, no attempt has been made to consider this question.

They proposed that the following important conclusions could be drawn:-

1. That patients falling into Groups 6 and 7 had a better prognosis with electro-shock treatment than patients falling into the other groups, regardless of diagnostic categories.
2. That more depressives fall into Groups 6 and 7 than did schizophrenics or normals.
3. That the small number of schizophrenics falling into Groups 6 and 7 had a good prognosis with electro-shock treatment, whereas depressives in Groups 1 to 5 had a relatively poor prognosis. This is in accord with the clinical experience that a small number of schizophrenics respond to electro-shock therapy and some depressives do not.
4. That there is a relative relationship between psychological and physiological change, and that a clinical improvement or recovery is accompanied by a change from Groups 6 and 7 to one of the other

groups, i.e. there is a tendency to approach a physiological normal.

This alteration in response takes place whether the improvement is spontaneous or due to electro-shock, insulin, or psychotherapy, and is independent of type of treatment. As a corollary of this, patients who do not recover with treatment and show no clinical change have no change in their response to adrenaline and methacholine hydrochloride.

They put the tentative hypothesis that patients who have a large and prolonged fall in systolic blood pressure in response to intramuscular methacholine hydrochloride are secretors of an excess of epinephrine-like substances, whereas the patients with a slight fall in blood pressure and who quickly attain homeostasis are secretors of an excess of nor-epinephrine-like substances.

In elaborating upon this theory of autonomic dysfunction in the psychoses FUNKENSTEIN et al (23) no longer refer to the adrenaline test, and this is in accord with the tendency to ignore the adrenaline test because it is extremely variable and has a low reliability.

They divide the patients into Type A and Type B, which represent the original Groups 6 and 7 and Groups 2 and 3 respectively. Type A patients have a large fall in systolic blood pressure and a failure to return to normal within 25 minutes. Type B patients have a moderate hypotensive response and the systolic blood pressure returns to normal within 25 minutes.

Type A are believed to have an excess of adrenaline secretion and Type B an excess of nor-adrenaline secretion at rest.

Electro-shock therapy is indicated in Type A but not in Type B.

Much of the recent work on the Funkenstein Test is concerned with the original classification into 7 groups and the classification into Type A and Type B is largely ignored.

L.ALEXANDER (1, 2 and 3) in general supports the work of Funkenstein and shows that in his practice a favourable prognosis is positively correlated with a classification into Group 6 or 7. He modifies the theoretical concept slightly and considers patients in Groups 6 and 7 to be cholinergic (Muscarine) over-reactors, and those in Group 1 to be adrenergic (nicotinic) over-reactors.

By measuring adrenaline excretion in response to methacholine hydrochloride in schizophrenic patients and normal controls F.ELMADJIAN, J.M.HOPE, and H.FREEMAN (13) claim that there is a positive correlation between area of fall of systolic blood pressure and adrenaline excretion in the urine of schizophrenics but not in the normal controls. They suggest that adrenaline or a related substance is implicated in depressing the excitability of the hypothalamus.

While accepting much of the clinical and experimental work of Funkenstein, Greenblatt and Solomons as being correct, E.GELLHORN (28) extends their concept of adrenaline and nor-adrenaline over-secretion and attempts to clarify the observed results from a neuro-physiological point of view. It is admitted that this presentation of the problem of functional mental disorders is over-simplified but still remains of great significance.

E.Gellhorn contends that there is no evidence to show that the essential physiological changes which occur in the psychoses are

peripheral in origin, and produces a large number of experimental tests to show that it is the central autonomic reactivity which is altered. He concludes that the observations of Funkenstein et al on systolic blood pressure changes are due to alterations in the sympathetic and parasympathetic centres of the posterior hypothalamus.

He considers that the adrenaline test as at present administered fails to give reliable and meaningful results, but suggests that the systolic blood pressure response to methacholine hydrochloride is an adequate indication of the degree of hypothalamic excitability.

If this is applied to the various groups of Funkenstein et al it can be shown that Groups 1 and 4 are characterised by hyper-reactivity of sympathetico-adrenal centres in response to methacholine, whereas Groups 5, 6 and 7 show a hyper-activity of the hypothalamic sympathetic centres. Groups 2 and 3 have a normal reaction.

The fundamental observation of Funkenstein that the prognosis with electro-shock therapy is associated with a particular autonomic reaction, in the form of a prolonged drop in systolic blood pressure with methacholine hydrochloride, and not with clinical diagnosis, suggests that sympathetic hyper-activity and the psychological concomitants are cured by any procedure that heightens central sympathetic reactivity. The theoretical concepts of Funkenstein, Greenblatt and Solomons are opposed by B.R.SLOANE, T.J.LEWIS, and P.SLATER (53, 54, 55 and 56) who found no evidence that the methacholine test was an indicator of hypothalamic reactivity, and they

were unable to confirm biochemically that patients with a Type A reaction of Funkenstein were over-secreting adrenaline.

They reported that their findings were the opposite of other workers and that the patients with the least disturbance of systolic blood pressure had the best prognosis.

In a later paper using a slightly different technique they confirm that the patients with least disturbance of homeostasis and the quickest restoration of systolic blood pressure have the best prognosis.

They consider the Funkenstein Test to be a poor predictor of the outcome of electro-shock therapy and they think the test has doubtful practical clinical value.

B.PASQUERELLI et al (47) substantially agrees that the pharmacodynamics are too poorly understood to allow for valid inferences to be made regarding the physiological meaning of the systolic blood pressure responses in the Funkenstein Test.

2. REVIEW OF LITERATURE SPECIFICALLY CONCERNED WITH RELIABILITY.

The Funkenstein Test has aroused widespread interest. This is not surprising, because if the claims made for it are true, it will be of great importance, not only practically as a method of selecting patients for treatment but also theoretically, for the light it casts on the relationship between autonomic function and the neuroses and mental disorders.

In view of this there has been surprisingly little attempt to assess the reliability of the test, despite the fundamental importance of this point.

As a cryptic footnote to one of their papers, FUNKENSTEIN et al (24) report that when two individuals classified the graphs of one hundred cases, they reached agreement in ninety-one of them. No further information is provided as to how or by whom this classification was carried out.

It is significant that the original article contains a mixed group of patients containing both sexes and consisting of numerous diagnostic categories, including one called "Miscellaneous". The tests were performed by nurses!

It is only recently that any further attempt has been made to assess the reliability of the test. T.E.WECKOWICZ (59) suggested that the test might be affected by diurnal variation, and designed an experiment to test this hypothesis. The test was administered to twenty patients divided into two groups and an attempt was made to discover whether there was any variation in their autonomic reactivity

corresponding to morning or evening.

This paper is open to severe criticism from several important aspects. In this small group two sub-groups were compared, giving only ten patients in each sub-group. Five of the patients were female and no indication was given as to their distribution within the sub-groups. This small group of twenty contained seven different diagnostic categories, including psychosis, neurosis, psychopathic personality and hypochondriasis. Until it is proven that sex and diagnosis have no effect on autonomic reactivity and the reliability of the test it cannot be assumed.

The blood pressure recordings were not carried out as frequently as suggested by Funkenstein.

WECKOWICZ has noted that five of the twenty patients altered in their autonomic response to methacholine hydrochloride and, surprisingly, thereafter excluded them from consideration. In analysing the results in the remaining fifteen patients it is not unexpected that he finds a high correlation between the first and second test, and comes to the conclusion that the Funkenstein test has a high reliability.

If the five patients showing change had been included in his calculations his conclusions might have been very different.

His results showed that there was no consistent diurnal variation.

An attempt by E.J.LOTSOF and J.JOBST (40) to establish the reliability of the test is open to similar criticism. Their

sample group consisted of thirty consecutive admissions to a psychiatric unit and they used fifteen medical students as controls. There is no information as to the diagnosis or type of psychiatric patient and the sex and age are not given. Normal controls are introduced but it is obvious that the test could be highly reliable in psychiatrics and not in normals. It has been observed by E.GELLHORN in discussing this aspect that "sick humans meet emergencies in atypical ways". In a test-re-test situation the reliability of the test on psychiatrics can be shown without comparison with normal controls.

In order to exclude diurnal variation the patient group was divided into two sub-groups of fifteen and the number of individuals in each section was, therefore, relatively small.

They observe that only seven tests gave a systolic blood pressure which did not return to normal within 25 minutes but "this might have been higher in nine cases if testing had not been halted before either the criterion or homeostasis was reached"!

If nine tests in such a small series were not completed and still included in the calculations it is reasonable to suppose that this affected their ultimate conclusions.

The patients were divided into Types A and B according to Funkenstein (22) criteria and whether an individual remained in the same group on re-testing was considered. "This analysis was carried out using the chi squared statistic. Of the thirty individuals twenty-seven of the B group and one of the A group did not change while seven individuals did change." This total of

thirty-five patients makes their statement meaningless and incomprehensible.

E.J.LOTSOF and J.YOBST conclude that the patients' reactions to methacholine hydrochloride have a low order of test-re-test reliability but the two quotations show that their conclusions are insecurely founded.

CAPTAIN J.W. MASS (43) investigated the reliability of the Funkenstein Test by measuring the variation in result when the test is performed on the same patient by different examiners.

The study was undertaken to show whether the test is entirely a measure of the effect of the drug on the patient with the observer playing a neutral role. Captain Mass suspected that the emotional reaction of the patient to the examiner and the test situation would affect the patient's reaction to methacholine hydrochloride.

Two examiners were chosen. One was a Physician and a Captain and represented an "authoritarian figure" and the other was a Staff Sergeant, who was thought to be a "non-threatening figure". It was considered that the latter would tend to produce poor prognostic test results. Twenty consecutive admissions containing seven different diagnostic categories were tested on the third and fourth day of admission. The initial test was performed alternately by the Captain and the Staff Sergeant so that the effect of re-testing could be avoided.

The findings did not confirm the theoretical formulation that the Physician would tend to get a greater number of favourable

test results because of the emotional attitude of the patient to the examiner. At this point it is admitted that the original belief, that the difference in rank would produce a different affective response in the patient, was rather naive.

A considerable variation in the results obtained by the examiners was, however, demonstrated and it was felt that the disparate results are a function of the examiner and the way in which he is perceived by the patient.

This is an interesting suggestion but depends on the assumption that there is a high degree of reliability in the repetition of the test when carried out by the same person and that there is a high patient constancy.

B.R.SLOAN, D.J.LEWIS and P.SLATER (55) in a series of test-re-test comparisons suggest that the Funkenstein Test has only a fair reliability and that it is only slightly improved when the two tests are performed by the same person. This was thought to be due largely to differences in technique but the authors agreed that some of it may be due to the personality of the observer,

All the tests were performed by nurses on one hundred and eleven cases with both sexes included and having eight different diagnostic categories. The carrying out of elaborate statistical analyses on the findings of nurses can only be deplored in a research project.

In an important paper by N.Q.BRILL, R.A.RICHARDS and L.M.BERGER (6) reference is made to an investigation by West, who is reported to have performed the Funkenstein test twelve times on each

of fifteen patients at two-day intervals. He found variations in the results of the tests from day to day, but the extent of the variation is not described. They also quote Ayd as having tested patients several times on the same day and observing variations within a few hours. Ayd, however, claimed that the patients fell into the same group most of the time, and he appears to have been satisfied that the test was reasonably reliable after having administered one thousand tests to four hundred patients. No exact figures are given and the conclusions appear to have been based on clinical impressions.

In their own observations they report on the performance of nineteen Funkenstein tests on a total of thirteen chronic schizophrenic patients. The tests were carried out by a Registered Nurse. When the blood pressure curves were classified into groups according to Funkenstein it was found that two showed no change, eight showed minor changes consisting of fluctuations between Group 1 and Group 2 - 3: three patients showed marked and significant variation. They stated, without giving evidence, that some of the variations in the group to which the patients were allocated were due to alterations in the base line for blood pressure, although the curves remained the same. Although they make some interesting comments on the theoretical basis of the Funkenstein Test and suggest further enquiry, they draw no conclusions as to the reliability of the test other than that under certain conditions there is some variation.

As there is no further published work on the reliability of the Funkenstein Test it must be concluded that no adequate investigation into the reliability of the test has so far been reported.

DESIGN OF ENQUIRY.

INTRODUCTION.

If the Funkenstein Test is to perform its function as a valid objective aid in psychiatric practice and is to be used as a predictor in electro-shock therapy it is of central importance to establish its reliability.

The test also has important theoretical concomitants which make it worthy of further investigation, but before this can be carried out it is necessary to know the degree of reliability of the test.

Any extension of the clinical application of the test depends upon a precise knowledge of its reliability.

Since the test is alleged to be a measure of the state of the autonomic nervous system it would be expected to vary from day to day in accord with the changing emotional and physiological state of the individual.

It is claimed for the test that it cuts across diagnostic categories and has been accepted as having the same reliability in schizophrenics and depressives although this has not been proven. Schizophrenics have a rigid autonomic balance with a tendency for the point of balance to vary (W.MEYER (44)).

It would be surprising indeed if the reliability of the test in schizophrenics did not differ from the reliability in depressives, from the point of view of function fluctuation.

On theoretical grounds it is reasonable to assume that

measures of autonomic reactivity are continuously variable and will have the distribution of a normal curve. Any attempt to classify patients into qualitatively different groups will be liable to error if the differences are qualitative.

Because of these considerations the central hypothesis of this investigation can now be stated; that the Funkenstein Test is highly unreliable and an enquiry has been designed to test this hypothesis.

The material and data will be used to test several other hypotheses.

MATERIAL AND METHOD.

Two populations were used for the investigations:-

Group 1. Chronic schizophrenic patients not under specific treatment.

Group 2. Depressives prior to receiving convulsive therapy.

Comparison will show whether there is any difference in reliability between schizophrenics and depressives.

Firty-five schizophrenics were chosen from a male population between the two groups of over eight hundred in accordance with defined criteria. Only patients between the ages of twenty and sixty were chosen and only those were included who had no personal or family history of epilepsy, and had no evidence of attack-disorder or syncope. No patient was included if he had had a head injury with unconsciousness or if a leucotomy had been performed. All patients with organic illness were carefully excluded, with special reference to cardiovascular disorders. No one was included if there was thought to be a possibility of underlying mental deficiency. None of the patients in the group had received any form of drug therapy or electro-shock therapy within a period of two months. Routine blood and urine analyses were normal and all had a negative Wassermann reaction. No borderline cases or cases with a dubious diagnosis were included, and care was taken to ensure that none of the group suffered from schizo-affective or schizo-

psychopathic syndromes. All patients in the group had been in hospital for over two years, and the majority were markedly regressed. They were considered to be the most consistent and unchanging group in the hospital from the point of view of affective variation.

Twenty depressed patients between the ages of twenty and sixty were carefully selected from two hundred consecutive admissions to an Acute Male Admission Ward. All patients were subjected to a general physical examination and Laboratory and Radiological investigation. If there was any evidence of disease or deviation from normal they were excluded from consideration. All the patients chosen had a negative Wassermann, normal blood urea, and normal liver function test; they all had a negative chest X-Ray.

Three Physicians independently examined the patients from a psychiatric point of view, and afterwards discussed their findings. If there was any doubt as to the exact diagnosis of the patient he was excluded from this series.

It is not relevant to this enquiry other than to establish certainty of diagnosis, but all those patients were carefully assessed on a rating scale for depression. These patients formed a homogeneous group of severe depressives, and any patients who showed marked anxiety, or could possibly be diagnosed as anxiety depressives, and all the patients having symptoms which could be interpreted as evidence of schizophrenia, have been excluded.

METHOD.

The schizophrenics were divided into three groups at random; a table of random numbers being used for this purpose. Each group of patients was tested twice at intervals of one, three, and fourteen days respectively. Similarly the depressed patients were divided at random into two separate groups, and each group was tested at one and three days respectively. It was not considered justifiable in the present state of knowledge to postpone treatment in those acute depressive cases for a period of fourteen days.

Each patient was given his first and second test under carefully standardised and basal conditions. All the tests were performed at the same time of the day in order to exclude the possibility of diurnal variation. They were tested in a quiet room, secluded from the main stream of the hospital, at least two hours after the last meal, and after having rested for at least an hour. The room was well ventilated and centrally heated, and was, therefore, independent of climatic variation, although exact room temperatures were not recorded.

Previous work has suggested that the methacholine hydrochloride preparation being used was perhaps in some instances inactive, and special arrangements were made for ampoules to be supplied with an expiry date of one month, and the adrenaline solutions used were always freshly prepared. The same instruments were used and every effort was made to exclude variability in technique of the administration of the drugs and the recording of the results.

The patient's blood pressure was taken by the cuff and auscultatory method, and the readings were recorded on a specially prepared sheet, a specimen of which is contained in the appendix. Preliminary recordings were made at half-minute intervals for at least five minutes or until such time as the patient's blood pressure remained stable. 0·025 mgms. of adrenaline was then injected intravenously and the blood pressure recorded every quarter of a minute for two minutes, and thereafter every two minutes for seven minutes or until the blood pressure returned to the previous basal level. An intramuscular injection of 10 mgms. of methacholine hydrochloride was given and the blood pressure again recorded at half-minute intervals for seven minutes; one minute intervals for six minutes, and two minute intervals for twelve minutes; that is, serial blood pressure readings were taken for a total of twenty-five minutes. From these results a graph was drawn.

Each patient was now represented by two graphs, representing his autonomic reactivity as tested by his adrenaline and methacholine hydrochloride reaction at a stated time-interval. These graphs were examined and classified into their seven various groups according to Funkenstein's criteria. The classification was made by two Physicians familiar with the Funkenstein Test and who assessed the graphs independently. They again assessed the graphs after a period of fourteen days.

The first assessment of the test could now be compared with the second assessment for both Physicians independently, and

the assessments by the two Physicians could be compared with each other, and the percentages of misclassifications obtained. These percentages are a measure of the reliability of the test. The tables of assessment are contained in the appendix. IV

The two groups of patients were assessed separately to determine whether the diagnosis had any relation to reliability.

A comparison made between the pairs of tests classified according to the time intervals between them demonstrates whether or not the reliability varies with time.

It can be readily seen that the final assessment of the reliability of the Funkenstein Test depends upon the reliability of its various component parts. There is a possibility of error in blood pressure readings. This has been shown by Shock and Ogden to be highly reliable with a probable error of $\pm$ 8 mms. Hg. It is unlikely that this would have any statistical significance in the final assessment of the results. The question of alteration in the potency of the drugs has been dealt with, and an attempt was made to ensure, as far as possible, that the potency remained constant. The preparation of the drugs has been accepted as being standard and reliable.

The probability of technical errors in drawing the graphs is negligible. If these factors remain constant, and as the technique of carrying out the tests has been carefully standardised, the reliability of the test now depends on function fluctuation in the patient or the variability of the patient's

response to the drugs, and on the ability of the assessors to allocate the graphs consistently to the same group.

RESULTS

INTRODUCTION

Using Funkenstein's criteria two Physicians have independently classified the patients' graphs twice, with an interval between of fourteen days.

Using Gellhorn's theory of hypo-reactivity, normal and hyper-reactivity of the central sympathetic nervous system, they again independently classified the graphs twice, with an interval between of fourteen days. This data is tabulated in Appendix 1.

The depressives are numbered from 0010 to 0300. The figure 0 in front indicates that the graph is for an acute depressive and the final 01 or 2 indicates that the graph represents the first test or the second test at one or three days' interval respectively. The schizophrenics are numbered from 1010 to 1450. The 1 in front indicates that the graph belongs to the schizophrenic group and the terminal group 01, 2 or 3 indicates that the graph represents the first test or the test after one, three, or fourteen days respectively. In this way each graph is precisely described and located.

The classifications recorded are arranged in tables of distribution in Appendix 2. The comparisons made are denoted above the tables and the tables are numbered from 1 to 20.

Group 7 has been omitted as no patients fell into this category as described by Funkenstein. Group 8 has been

substituted because there were certain graphs which could not be classified in any of Funkenstein's groups.

The numbers within the diagonals indicate the graphs correctly and consistently classified and the numbers outside the diagonals indicate the misclassifications.

The tables 1a to 20a represent the comparisons made when the classification is according to Funkenstein's criteria, and tables 1b to 20b are the equivalent comparisons made when the classification is according to E.Gellhorn's theory. Tables 1c to 20c are the equivalent tables calculated from tables 1b to 20b by combining categories.

RESULTS.

Firstly considering the classification of the graphs of the depressives:-

Table 1a. This table compares the first Physician's first aassessment with his second assessment after an interval of fourteen days.

The number outside the diagonal or number of misclassifications is 15 out of 60.

There is a misclassification of 25%.

Table 2a. This table shows the second Physician's first assessment compared with his second assessment after fourteen days has a misclassification of 20 out of 60 or 33·33%.

These tables show that there is a large degree of error in the classification of the graphs of depressed patients when they are classified into seven groups in accord with Funkenstein's criteria. This error of classification is independent of the patients' fluctuation.

The misclassification is so large that the difference between the two Physicians is not significant.

Table 3a. This table shows that when the first Physician's first assessment is compared with the second Physician's first assessment there is a disagreement in 24 out of 60 cases or 40%.

Table 4a. This table shows that when the first Physician's second assessment is compared with the second Physician's second assessment there is a 30% disagreement.

Table 5a. This table shows that when the first Physician's first assessment is compared with the second Physician's second assessment there is a 31·67% disagreement.

Table 6a. This table shows that when the first Physician's second assessment is compared with the second Physician's first assessment there is a 40% disagreement.

These tables show that the disagreement between the assessments of the first and second Physician is only slightly higher than the misclassifications made by each Physician.

Table 7a. This table shows the patients' first graph compared with their second graph and assessed by the first Physician for the first time.

The misclassification is 70%.

Table 8a. This table shows the patients' first graph compared with their second graph as assessed by the first Physician for the second time.

The misclassification is 63·33%.

Table 9a. This table shows the patients' first graph compared with their second graph as assessed by the second Physician for the first time.

The misclassification is 66·66%.

Table 10a. This table shows the patients' first graph compared with their second graph as assessed by the second Physician for the second time.

The misclassification is 53·33%.

This very high percentage of error is produced by combining the error of classification of the Physicians with the function fluctuation of the patients.

When the following tables relating to the results of the Funkenstein test on schizophrenics are considered a very similar result is produced.

Table 11a. This table compares the first Physician's first assessment with his second assessment of the graphs of schizophrenics after an interval of fourteen days.

The misclassification is 38·89%.

Table 12a. This table shows the second Physician's first assessment compared with his second assessment after fourteen days.

The misclassification is 34·44%.

This means that the misclassification of the Physicians is very high and is consistent for both Physicians. The percentage misclassified in schizophrenics is comparable with the percentage misclassified in depressives.

Table 13a. This table shows that when the first Physician's first assessment is compared with the second Physician's first assessment there is a disagreement of 40%.

Table 14a. This table shows that when the first Physician's second assessment is compared with the second Physician's second assessment there is a disagreement of 42·22%.

Table 15a. This table shows that when the first Physician's first assessment is compared with the second Physician's second assessment there is a disagreement of 42·22%.

Table 16a. This table shows that when the first Physician's second assessment is compared with the second Physician's first assessment the disagreement is 35·55%.

Again these tables show that there is the same order of disagreement between the assessments of the two Physicians and the percentage of misclassification made by the Physicians.

There is the same order of misclassification as found when considering the graphs of depressives.

Table 17a. This table shows the patients' first graph compared with their second graph as assessed by the first Physician for the first time.

The misclassification is 60%.

Table 18a. This table shows the patients' first graph compared with their second graph as assessed by the first Physician for the second time.

The misclassification is 51·11%.

Table 19a. This table shows the patients' first graph compared with their second graph as assessed by the second Physician for the first time.

The misclassification is 64·44%.

Table 20a. This table shows the patients' first graph compared with their second graph as assessed by the second Physician for the second time.

The misclassification is 44·44%.

Again this high percentage of error is a combination of the

Physicians' error of classification and the patients' fluctuation.

The percentage of error is of the same order for both schizophrenics and depressives.

Although there is a high percentage of misclassification shown in all the tables it can readily be seen that there is a much larger allocation of graphs to certain cells in the tables than could be explained by chance. This suggested that the reliability of classification could be increased by using different criteria.

Both Physicians, therefore, classify the graphs according to Gellhorn's theory of central sympathetic reactivity.

The classification appeared to be simpler and more realistic and the results show that there is a much lower percentage of misclassification in each comparison. When tables 1b to 6b are compared with tables 1a to 6a they show that when the Physicians' first and second assessments are compared and when their assessments are compared with each other there is a marked improvement in the percentage of misclassification.

Tables 7b to 10b show a similar improvement in misclassification although these tables include the patients' variation, which remains constant. The whole improvement is due to a better method of classification.

A similar improvement is noted when the tables relating to schizophrenics are compared. The error of classification, however, still remains too high for the Funkenstein test to have any

useful clinical application.

If, however, indicating hypo-reactivity of the central sympathetic nervous system and using this hypo-reactivity as a prediction in electro-shock therapy is the primary function of the Funkenstein test, it is now adequate to divide patients into hypo-reactors and others.

As the tables 1b to 20b show that no patient in Group 3 was misclassified into group 1, and no patient in Group 1 was misclassified into Group 3, it is practical to combine categories without decreasing the usefulness of the test.

By combining the categories of hypo-reactors and normal reactors the equivalent tables 1c to 20c have been calculated from 1d to 20d.

For each table a chi-square and a value for 'p' have been calculated.

A contingency co-efficient 'C' has been calculated for each table using the method described in "Non-parametric Statistics" (For the Behavioural Sciences) by Sydney Siegal.

SUMMARY OF PROCEDURE.

The observed frequencies have been arranged in a K x R contingency table.

The expected frequency of each cell has been determined. If more than 20% of the cells have an expected frequency of less than five or if any cell has less than one, categories must be combined to increase the expected frequencies. This has been done in tables 1c to 20c.

A chi square test for 2 x 2 tables (with one degree of freedom) has been calculated from the following formula

a	b	(a+b)
c	d	(c+d)
(a+c)	(b+d)	N

$$\frac{(ad + bc)^2 \times N}{(a+c)(b+d)(a+b)(c+d)}$$

From the chi square obtained a value for 'C' was computed from the formula

$$'C' = \sqrt{\frac{\chi^2}{N + \chi^2}}$$

LIMITATIONS.

The upper limit of 'C' is not the same as other coefficients which have an upper limit of one. 'C' has an upper limit of less and it depends upon the number of cells in the table.
K = No. of rows = No. of columns.

$$'C' = \sqrt{\frac{k-1}{k}} = .707 \quad (k=2)$$

In this case 'C's' upper limit = .707.

'C' depends upon the chi square which must have sufficient numbers in each cell as defined.

'C' is not directly comparable with other measures of correlation, e.g. Spearman r and Pearson or Kendall τ

In spite of these limitations it is extremely useful because

of its wide applicability. This contingency coefficient has a freedom from assumptions and requirements and makes no assumptions about shape.

In the tables 1c to 20c it can be readily seen that the values for 'p' indicate that there is practically no possibility of the tables having occurred by chance. In most cases 'p' gives a value of ·001, the worst value for 'p' is in table 7c where it equals ·05.

When it is remembered that the upper limit for 'C' is ·707 the contingency coefficients for those tables are extremely high. They are, in fact, much higher than is usually found in tests of this kind.

This means that when the Funkenstein test is classified into hypo-reactors on the one hand and normal and hyper-reactors on the other hand, which is roughly equivalent to Funkenstein's Type A and Type B categories it has an extremely high reliability.

Appendix 3 shows the misclassification obtained in relation to the time intervals between the first and second test. It can readily be seen that although there is some difference in the percentage of misclassification there is no consistent pattern related to the one day, three day, or fourteen day interval.

The expected increase in misclassification due to the patients' variation increasing with time has not been shown.

DISCUSSION AND CONCLUSIONS.

Because of the important theoretical and practical implications of the Funkenstein Test it is necessary to have an exact knowledge of its reliability. The present investigation has been undertaken because no adequate test of reliability has yet been published.

It has been demonstrated that when an attempt has been made to classify the graphs of the patients' systolic blood pressure responses according to Funkenstein's criteria the percentage of misclassifications is very high and the test appears to be highly unreliable.

When the classification is carried out according to Gellhorn's theory of autonomic reactivity there is a marked increase in the reliability of classification, although the percentage of misclassifications still remains too high to be of real clinical value.

If the categories for hyper-reactivity and normal reactivity are combined the reliability becomes extremely high. This combining of categories is quite permissible if the test is being used as a predictor in the outcome of electro-shock therapy. This is, of course, the essential practical clinical value of the test.

M.HAMILTON (personal communications) has suggested that the maximum fall of systolic blood pressure and response to intramuscular methacholine hydrochloride is highly reliable and has a valid predictive value. This may also increase the reliability of the test still further. If this suggestion is true the test could be carried

out in a few minutes, whereas at present the completion of the test and the drawing of the graph of systolic blood pressure response takes nearly one hour; a very important consideration in any busy admission unit.

BRILL et al (6) have suggested that patients tend to change from one group to another because the basal systolic blood pressure changes while the curve remains the same. The data in this investigation does not support this contention as the basal systolic blood pressure was found to be highly consistent and reliable.

The argument of SLOANE et al (53) that patients who have the least reaction to adrenaline and methacholine hydrochloride will respond more satisfactorily to electro-shock therapy is not supported by the evidence of this investigation.

Tables 1c to 6c show that 50% of the acute depressives consistently fall into Group 3 whereas only 20% of chronic schizophrenics consistently fall into this group as shown by tables 11c to 16c. This latter figure of 20% is higher than would be expected if Funkenstein's theory is correct considering the chronicity of the schizophrenic population examined.

Some investigators have noted (45 and 46) that in general individuals have a consistent autonomic pattern or profile, but a few individuals have widely varying autonomic activity.

No mention of this is made in any of the enquiries into the Funkenstein Test. A possible explanation for this may be that in many of the investigations the test has been performed by nurses.

In this series a number of patients showed very abnormal responses.

Some patients showed little or no reaction to methachlorine hydrochloride and the variation in systolic blood pressure from the basal blood pressure was within the $\pm$ 8 mm. Hg. suggested as the limits of accuracy of blood pressure readings.

The explanation for this may simply be that the drug has not been absorbed or it may be more complex in that the patient may have an ability to maintain homeostasis in spite of an injection of methacholine hydrochloride.

All patients appeared to return to the basic blood pressure level through a series of approximations but a few patients showed such a rapid and wide fluctuation in blood pressure that it could only have been accurately measured by some form of continuous recording.

Some patients showed a marked fall in blood pressure in response to intravenous adrenaline with a subsequent rise above normal, and a few showed a fall in blood pressure with a subsequent return to normal without any rise above the basal level. No explanation for this phenomenon is offered but plainly it calls for further investigation. It was considered that the recording of these aberrent reactions was an important aspect of the investigation.

In clinical practice it would have been possible to have rejected some of those patients with a consequent increase in the reliability of the test. None were, of course, excluded from this series as this would have led to selection and bias.

E. GELLHORN (28) contends that hypothalamic sympathetic reactivity decreases with age, and this is supported by the data in this investigation.

Only one of the schizophrenic cases with a consistent hypotensive response to methacholine hydrochloride was under the age of fifty.

This might partly explain why there is a greater percentage of hypotensive reactions in depressive patients than in schizophrenics. The depressed patients in this investigation have a slightly higher age distribution than the schizophrenics.

This observation does not necessarily impair the reliability or the validity of the test, as there is a tendency for the incidence of depressive illnesses to increase with age.

CONCLUSIONS.

1. The Funkenstein Test has a high reliability when used to select patients with a hypothalamic sympathetic hypo-reactivity, in order to use this as a predictor in electro-shock therapy.

When schizophrenic and depressive patient s are considered together and when error of classification and function fluctuation are combined the average value for 'C' is ·49 (upper limit of 'C' is ·707).

2. There is little difference in reliability between schizophrenic and depressive patients.

The average value for 'C' in schizophrenics is ·5 and the average value for 'C' in depressives is ·48.

3. There is no constant relationship betwen the test-re-test interval and reliability. Variarion in the patients' response does not appear to increase with time. (Appendix 3).

4. The loss of reliability is due to errors of classification combined with function fluctuation in the patient.

When error of classification is considered alone the value of 'C' is .62. When this is combined with function fluctuation the value of 'C' falls to .49.

5. The Funkenstein Test is highly unreliable when it is used to classify patients into seven autonomic groups according to Funkenstein's criteria. The error of misclassification is very high.

6. The Funkenstein Test cuts across diagnostic categories.

SUMMARY.

1. Reasons are given for investigating the reliability of the Funkenstein Test.

2. There is a brief review of the literature relating to the Funkenstein Test. Attention is drawn to the importance of elucidating the problem of the relationship between mental illness and neuro-endocrine and autonomic imbalance.

3. The available literature on the reliability of the Funkenstein Test is considered and it is shown that much of the work suffers from serious defects.

4. An account of the design of the present investigation is given. The method of selecting the patients; performing the Funkenstein Test and assessing its reliability is described.

5. The data is recorded in the Appendices and the findings are analysed.

6. Some of the problems relating to the Funkenstein Test are discussed and it is indicated that further investigation is required.

7. The conclusions to be drawn from this investigation are given.

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APPENDIX 1.

DEPRESSIVES.

Patient's No.	Age	Basal B.P.	Funkenstein's Classification				Gellhorn's Classification			
			1st Phys.		2nd Phys.		1st Phys.		2nd Phys.	
			1st	2nd	1st	2nd	1st	2nd	1st	2nd
0010	42	142	1	3	3	3	2	2	2	2
0011		130	3	3	3	3	2	2	2	2
0020	55	170	6	6	8	3	3	3	3	3
0022		156	5	5	5	5	3	3	3	3
0030	46	181	6	6	5	3	3	3	3	3
0032		168	6	6	6	6	3	3	3	3
0040	40	112	3	3	4	3	2	2	2	2
0041		114	5	5	5	5	3	2	3	3
0050	40	152	6	6	3	3	3	3	3	3
0052		125	1	3	8	5	2	2	2	2
0060	46	144	5	3	5	5	3	2	2	3
0062		147	3	3	3	3	2	2	2	2
0070	55	125	4	3	4	3	3	3	3	3
0071		115	5	5	5	5	3	3	3	3
0080	48	169	5	5	5	5	3	3	3	3
0081		170	5	5	5	5	3	3	3	3
0090	47	132	3	8	4	3	2	2	2	1
0092		136	3	3	8	5	2	2	2	2
0100	56	134	5	5	5	5	3	3	3	3
0102		124	5	5	5	5	3	3	3	3
0110	57	140	5	3	3	5	3	3	3	3
0111		140	3	5	4	4	3	3	3	3
0120	54	140	4	3	4	3	3	3	3	3
0121		120	1	6	2	3	3	3	2	3
0130	53	130	3	5	5	3	3	2	3	3
0132		120	4	4	4	4	3	2	3	3
0140	41	138	6	6	6	6	3	3	3	3
0141		131	6	6	6	6	3	3	3	3
0150	49	132	1	3	4	4	2	2	1	2
0152		144	4	4	4	4	2	2	2	2

Patient's No.	Age	Basal B.P.	Funkenstein's Classification				Gellhorn's Classification			
			1st Phys. 1st	1st Phys. 2nd	2nd Phys. 1st	2nd Phys. 2nd	1st Phys. 1st	1st Phys. 2nd	2nd Phys. 1st	2nd Phys. 2nd
0160	35	131	3	3	3	3	2	2	2	2
0162		126	4	4	4	4	2	2	2	2
0170	36	101	1	1	2	3	2	2	2	2
0172		128	3	5	5	5	3	2	3	3
0180	59	143	5	5	6	6	2	3	3	3
0182		134	8	4	8	4	3	3	3	3
0190	58	150	5	5	5	5	3	3	3	3
0191		146	5	5	5	5	3	3	3	3
0200	37	134	2	2	4	3	2	2	2	2
0201		132	3	3	3	3	3	2	2	3
0210	37	152	6	6	6	6	3	3	3	3
0212		154	6	6	6	6	3	3	3	2
0220	29	132	3	3	3	3	2	2	2	2
0222		126	3	3	4	3	2	2	2	2
0230	48	134	5	5	5	5	3	3	3	3
0231		140	4	4	4	4	3	3	2	3
0240	53	146	5	5	8	8	3	3	3	3
0242		154	8	8	5	8	3	3	3	3
0250	47	114	3	3	4	3	2	2	1	1
0252		114	4	5	4	4	1	1	1	1
0260	28	130	3	3	4	3	2	2	2	1
0261		132	3	3	3	3	2	2	2	2
0270	37	122	3	3	3	3	3	3	3	3
0271		136	5	5	3	3	3	2	3	3
0280	42	132	3	3	3	3	2	2	2	2
0281		134	5	5	5	5	3	3	3	3
0290	57	106	3	3	3	3	2	2	2	2
0291		100	5	5	5	5	3	2	2	2
0300	57	124	1	3	3	3	2	2	3	2
0301		134	3	3	3	3	3	2	2	2

SCHIZOPHRENICS.

Patient's No.	Age	Basal B.P.	Funkenstein's Classification				Gellhorn's Classification			
			1st Phys. 1st	1st Phys. 2nd	2nd Phys. 1st	2nd Phys. 2nd	1st Phys. 1st	1st Phys. 2nd	2nd Phys. 1st	2nd Phys. 2nd
1010	31	109	1	3	3	4	2	2	1	2
1013		120	3	3	3	3	3	2	2	2
1020	36	104	4	3	3	3	2	2	2	2
1023		100	3	3	3	3	2	2	2	2
1030	45	127	3	3	3	3	2	2	2	2
1033		131	5	5	5	5	2	2	2	2
1040	57	149	2	6	3	6	3	3	3	3
1042		166	5	5	5	5	3	3	3	3
1050	50	104	3	3	8	3	2	2	1	2
1053		98	3	3	8	5	2	2	2	2
1060	44	131	3	3	3	3	2	2	2	2
1061		144	2	1	3	3	3	3	3	2
1070	59	124	5	6	5	5	3	3	3	3
1073		128	5	5	8	5	3	3	3	3
1080	54	116	3	3	3	5	2	2	1	2
1081		132	4	3	4	4	2	2	2	2
1090	57	120	3	3	3	3	2	2	2	2
1092		122	5	5	5	5	3	3	2	3
1100	44	112	3	3	3	4	2	2	2	2
1102		114	3	8	8	8	1	1	1	1
1110	42	107	3	3	3	3	2	2	2	2
1111		106	5	3	5	5	2	2	2	2
1120	39	114	4	8	4	4	2	2	1	2
1122		113	3	3	3	3	2	2	2	2
1130	43	124	4	3	3	4	3	3	2	2
1131		117	3	4	4	3	3	3	3	3
1140	54	119	5	5	5	5	3	3	3	3
1141		117	5	3	5	5	3	3	2	2
1150	58	129	4	3	4	3	2	3	3	2
1151		127	3	5	5	3	3	3	3	3

Patient's No.	Age	Basal B.P.	Funkenstein's Classification				Gellhorn's Classification			
			1st Phys. 1st	1st Phys. 2nd	2nd Phys. 1st	2nd Phys. 2nd	1st Phys. 1st	1st Phys. 2nd	2nd Phys. 1st	2nd Phys. 2nd
1160	45	110	4	3	4	4	2	2	2	2
1163		98	4	1	4	4	2	2	1	1
1170	48	150	5	5	5	5	3	3	3	3
1172		127	4	3	3	3	2	2	2	2
1180	35	120	3	3	3	3	2	2	2	2
1181		109	3	3	4	3	3	3	2	2
1190	50	120	3	3	3	5	2	2	2	2
1193		119	5	5	5	5	3	3	3	3
1200	39	134	4	3	4	4	2	2	1	1
1201		125	4	4	4	4	1	1	1	1
1210	55	126	3	3	3	3	3	3	3	3
1213		130	4	4	4	3	3	3	3	3
1220	46	118	4	3	3	3	2	2	1	2
1221		125	3	8	3	3	2	2	2	2
1230	33	124	3	3	5	5	2	2	2	2
1231		113	5	3	8	5	2	2	2	2
1240	29	128	3	3	5	3	2	2	2	2
1242		124	3	3	3	3	2	2	2	2
1250	31	107	4	4	4	4	2	1	2	2
1252		104	3	3	3	3	2	2	2	2
1260	39	120	3	3	3	4	2	2	1	2
1262		122	3	3	3	3	2	2	2	2
1270	39	120	1	4	3	4	1	1	1	1
1272		130	1	4	4	4	1	1	1	2
1280	38	90	3	3	3	5	2	2	2	2
1281		91	3	8	3	3	2	2	2	2
1290	59	131	3	3	3	3	3	2	2	3
1292		110	3	3	3	3	2	2	2	2
1300	53	122	3	3	3	3	2	2	2	2
1301		116	3	3	4	3	2	2	2	2

Patient's No.	Age	Basal B.P.	Funkenstein's Classification				Gellhorn's Classification			
			1st Phys. 1st	1st Phys. 2nd	2nd Phys. 1st	2nd Phys. 2nd	1st Phys. 1st	1st Phys. 2nd	2nd Phys. 1st	2nd Phys. 2nd
1310	57	170	5	4	4	4	3	3	3	3
1313		166	3	4	8	3	3	3	3	3
1320	37	120	3	3	3	3	2	2	2	2
1322		108	1	4	4	4	1	1	1	1
1330	44	114	3	3	4	4	2	2	2	2
1331		114	3	3	3	3	2	2	2	2
1340	45	118	3	3	3	3	2	2	2	2
1343		106	3	3	4	3	2	2	2	1
1350	37	106	3	3	3	3	2	2	2	2
1351		98	3	3	3	3	2	2	2	2
1360	49	152	5	5	6	5	3	3	3	3
1363		142	5	5	5	5	3	3	3	3
1370	33	148	4	4	4	3	3	3	3	3
1372		134	3	5	3	3	3	3	3	3
1380	30	120	5	3	5	5	2	2	2	2
1383		138	3	3	3	5	2	2	2	2
1390	26	141	3	3	3	3	2	2	2	2
1392		100	4	4	8	3	1	1	1	1
1400	30	104	3	3	3	3	2	2	2	2
1401		104	3	3	3	5	2	2	2	2
1410	52	89	5	3	3	5	2	2	2	2
1413		116	1	3	3	3	2	2	2	2
1420	26	80	4	3	3	3	2	2	2	2
1422		110	3	3	3	3	2	2	2	2
1430	34	128	3	3	3	4	2	2	2	2
1433		116	4	3	4	4	2	2	2	2
1440	30	142	4	4	4	4	1	1	1	1
1443		132	1	1	4	3	2	2	2	2
1450	33	116	8	5	8	8	3	2	3	3
1452		124	3	8	3	3	2	2	2	1

APPENDIX 2.

1a. DEPRESSIVES.

1st Physician's 1st assessment compared with 2nd assessment.

1st Assessment. \ 2nd assessment.	1	2	3	4	5	6	8	
1	1	0	4	0	0	1	0	6
2	0	1	0	0	0	0	0	1
3	0	0	15	0	3	0	1	19
4	0	0	2	4	1	0	0	7
5	0	0	2	0	15	0	0	17
6	0	0	0	0	0	8	0	8
8	D	0	0	1	0	0	1	2
	1	1	23	5	19	9	2	60

No. of misclassifications = 15 or 25%.

1b.

1st Assessment \ 2nd assessment.	1	2	3	
1	1	0	0	1
2	0	21	1	22
3	0	9	28	37
	1	30	29	60

No. of misclassifications = 10 or 15·83%.

2a. DEPRESSIVES

2nd Physician's 1st assessment compared with 2nd assessment.

1st Assessment \ 2nd assessment	1	2	3	4	5	6	8	
1	0	0	2	0	0	0	0	2
2	0	0	2	0	0	0	0	2
3	0	0	12	0	1	0	0	13
4	0	0	8	7	0	0	0	15
5	0	0	2	0	14	0	1	17
6	0	0	0	0	0	6	0	6
8	0	0	1	1	2	0	1	5
	0	0	27	8	17	6	2	60

No. of misclassifications = 20 or 33·33%.

2b.

1st Assessment \ 2nd assessment	1	2	3	
1	2	1	0	3
2	2	18	4	24
3	0	2	31	33
	4	21	35	60

No. of misclassifications = 9 or 15%.

DEPRESSIVES.

3a.

1st Physician's 1st assessment compared with 2nd Physician's 1st assessment.

2nd Physician. 1st Assessment	1st Physician's 1st assessment. 1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	2	0	0	0	0	0	0	2
3	2	0	10	0	2	1	0	15
4	1	1	6	7	0	0	0	15
5	0	0	2	0	13	1	1	17
6	0	0	0	0	1	5	0	6
8	1	0	1	0	1	1	1	5
	6	1	19	7	17	8	2	60

No. of misclassifications = 24 or 40%.

3b.

2nd Physicians. 1st Assessment.	1st Physician's 1st assessment. 1	2	3	
1	1	2	0	3
2	0	17	6	23
3	0	2	32	34
	1	21	38	60

No. of misclassifications = 10 or 15·83%.

DEPRESSIVES

4a.

1st Physician's 2nd assessment compared with 2nd Physician's 2nd assessment

2nd Physicians. 2nd Assessment.	1st Physician's 2nd assessment. 1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	1	1	18	0	2	4	1	27
4	0	0	1	5	2	0	0	8
5	0	0	4	0	13	0	0	17
6	0	0	0	0	1	5	0	6
8	0	0	0	0	1	0	1	2
	1	1	23	5	19	9	2	60

No. of misclassifications = 18 or 30%.

4b.

2nd Physicians. 2nd Assessment.	1st Physician's 2nd assessment. 1	2	3	
1	1	3	0	4
2	0	19	1	20
3	0	7	29	36
	1	29	30	60

No. of misclassifications = 11 or 18·33%.

DEPRESSIVES.

5a.

1st Physician's 1st assessment compared with 2nd Physician's 2nd assessment

2nd Physician. 2nd Assessment.	1st Physician's 1st assessment. 1	2	3	4	5	6	8	
1	0	0	1	0	0	0	0	1
2	0	0	0	0	0	0	0	0
3	3	1	16	2	1	3	0	26
4	1	0	1	5	0	0	1	8
5	1	0	2	0	14	0	0	17
6	0	0	0	0	1	5	0	6
8	0	0	0	0	1	0	1	2
	5	1	20	7	17	8	2	60

No. of misclassifications = 19 or 31·67%.

5b.

2nd Physician. 2nd Assessment	1st Physician's 1st assessment. 1	2	3	
1	1	3	0	4
2	0	17	3	20
3	0	1	35	36
	1	21	38	60

No. of misclassifications = 7 or 11.67%.

DEPRESSIVES.

7a.

1st Physician's 1st assessment of 1st graph compared with 2nd graph.

1st Test Graph \ 2nd test graph.	1	2	3	4	5	6	8	
1	0	0	3	1	0	0	0	4
2	0	0	1	0	0	0	0	1
3	0	0	3	3	4	0	0	10
4	1	0	0	0	1	0	0	2
5	0	0	2	1	3	0	2	8
6	1	0	0	0	1	3	0	5
8	0	0	0	0	0	0	0	0
	2	0	9	5	9	3	2	30

No. of misclassifications = 21 or 70%.

7b

1st Test Graph \ 2nd test graph.	1	2	3	
1	0	0	0	0
2	1	6	7	14
3	0	2	14	16
	1	8	21	30

No. of misclassifications = 10 or 33.33%.

8a.

1st Physician's 2nd assessment of 1st graph compared with 2nd graph.

1st Test Graph \ 2nd test graph.	1	2	3	4	5	6	8	
1	0	0	0	0	1	0	0	1
2	0	0	1	0	0	0	0	1
3	0	0	5	2	7	1	0	15
4	0	0	0	0	0	0	0	0
5	0	0	0	3	3	0	1	7
6	0	0	1	0	1	3	0	5
8	0	0	1	0	0	0	0	1
	0	0	8	5	12	4	1	30

No. of misclassifications = 19 or 63·33%.

8b.

1st Test Graph \ 2nd test graph.	1	2	3	
1	0	0	0	0
2	1	12	1	14
3	0	2	14	16
	1	14	15	30

No. of misclassifications = 4 or 19·99%.

9a

DEPRESSIVES.

2nd Physician's 1st assessment of 1st graph compared with 2nd graph.

1st Test Graph \ 2nd test graph.	1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	2	0	0	2
3	0	0	3	3	1	0	1	8
4	0	1	2	2	2	0	1	8
5	0	0	1	2	3	1	0	7
6	0	0	0	0	0	2	1	3
8	0	0	0	0	2	0	0	2
	0	1	6	7	10	3	3	30

No. of misclassifications = 20 or 66·66%.

9b

1st Test Graph \ 2nd test graph.	1	2	3	
1	1	1	0	2
2	0	8	3	11
3	0	4	13	17
	1	13	16	30

No. of misclassifications = 8 or 26·67%.

10a. DEPRESSIVES

2nd Physician's 2nd assessment of 1st graph compared with 2nd graph.

1st Test Graph \ 2nd test graph.	1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	7	3	8	1	0	19
4	0	0	0	1	0	0	0	1
5	0	0	1	2	3	0	0	6
6	0	0	0	1	0	2	0	3
8	0	0	0	0	0	0	1	1
	0	0	8	7	11	3	1	30

No. of misclassifications = 16 or 53·33%.

10b.

1st Test Graph \ 2nd test graph.	1	2	3	
1	1	2	0	3
2	0	6	4	10
3	0	3	14	17
	1	11	18	30

No. of misclassifications = 9 or 30%.

SCHIZOPHRANICS.

11a. 1st Physician's 1st assessment compared with 2nd assessment.

1st Assessment \ 2nd assessment.	1	2	3	4	5	6	8	
1	1	0	2	3	0	0	0	6
2	1	0	0	0	0	1	0	2
3	0	0	39	2	2	0	4	47
4	1	0	10	6	0	0	1	18
5	0	0	5	1	9	1	0	16
6	0	0	0	0	0	0	0	0
8	0	0	0	0	1	0	0	1
	3	0	56	12	12	2	5	90

No. of misclassifications = 35 or 38·89%.

11b.

1st Assessment \ 2nd assessment	1	2	3	
1	7	0	0	7
2	1	56	2	59
3	0	3	21	24
	8	59	23	90

No. of misclassifications = 6 or 6·67%.

SCHIZOPHRENICS.

12a.

2nd Physician's 1st assessment compared with 2nd assessment.

1st Assessment \ 2nd assessment.	1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	32	6	6	1	0	45
4	0	0	9	13	0	0	0	22
5	0	0	2	0	12	0	0	14
6	0	0	0	0	1	0	0	1
8	0	0	3	0	3	0	2	8
	0	0	46	19	22	1	2	90

No. of misclassifications = 31 or 34.44%.

12b.

1st Assessment \ 2nd assessment.	1	2	3	
1	8	7	0	15
2	2	51	2	55
3	0	2	18	20
	10	60	20	90

No. of misclassifications = 13 or 14.44%.

SCHIZOPHRENICS.

13a. 1st Physician's 1st assessment compared with 2nd Physician's 1st assessment.

2nd Physician. 1st Assessment	1st Physician's 1st assessment. 1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	3	2	35	7	1	0	0	48
4	3	0	5	10	1	0	0	19
5	0	0	3	0	11	0	0	14
6	0	0	0	0	1	0	0	1
8	0	0	4	1	2	0	1	8
	6	2	47	18	16	0	1	90

No. of misclassifications = 36 or 40$\frac{2}{3}$.

13b.

2nd Physician. 1st Assessment	1st Physician's 1st assessment. 1	2	3	
1	7	8	0	15
2	0	54	5	59
3	0	1	15	16
	7	63	20	90

No. of misclassifications = 14 or 15·55%.

14a 1st Physician's 1st assessment compared with 2nd Physician's 2nd assessment.

2nd Physician. 2nd Assessment	1st Physician's 2nd assessment. 1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	2	0	34	5	2	0	3	46
4	2	0	9	7	0	0	1	19
5	0	0	12	0	9	1	0	22
6	0	0	0	0	0	1	0	1
8	0	0	0	0	1	0	1	2
	4	0	55	12	12	2	5	90

No. of misclassifications = 38 or 42·22%.

14b

2nd Physician. 2nd Assessment	1st Physician's 2nd assessment. 1	2	3	
1	6	4	0	10
2	2	53	5	60
3	0	2	18	20
	8	59	23	90

No. of misclassifications = 13 or 14·44%.

15a 1st Physician's 1st assessment compared with 2nd Physician's 2nd assessment.

2nd Physician. 2nd Assessment	1st Physician's 1st assessment. 1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	2	1	35	8	0	0	0	46
4	4	0	4	10	1	0	0	19
5	0	0	7	0	15	0	0	22
6	0	1	0	0	0	0	0	1
8	0	0	1	0	0	0	1	2
	6	2	47	18	16	0	1	90

No. of misclassifications = 30 or 33·33%.

15b

2nd Physician. 2nd Assessment	1st Physician's 1st Assessment. 1	2	3	
1	6	4	0	10
2	1	54	4	59
3	0	0	21	21
	7	58	25	90

No. of misclassifications = 9 or 10%.

SCHIZOPHRENICS.

16a

1st Physician's 2nd assessment compared with 2nd Physician's 1st assessment.

2nd Physician. 1st Assessment \ 1st Physician's 2nd assessment.	1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	1	0	39	1	1	1	3	46
4	2	0	9	9	0	0	1	21
5	0	0	5	0	8	1	0	14
6	0	0	0	0	1	0	0	1
8	0	0	3	2	2	0	1	8
	3	0	56	12	12	2	5	90

No. of misclassifications = 33 or 35·55%.

16b

2nd Physician. 1st Assessment \ 1st Physician's 2nd assessment.	1	2	3	
1	7	8	0	15
2	1	50	4	55
3	0	1	19	20
	8	59	23	90

No. of misclassifications = 14 or 15·55%.

SCHIZOPHRENICS.

17a

1st Physician's 1st assessment of 1st Graph compared with 2nd graph.

2nd Test Graph \ 1st Test Graph.	1	2	3	4	5	6	8	
1	1	0	1	0	0	0	0	2
2	0	0	0	0	1	0	0	1
3	1	1	12	4	5	0	0	23
4	1	0	8	2	0	0	0	11
5	1	0	2	1	3	0	0	7
6	0	0	0	0	0	0	0	0
8	0	0	1	0	0	0	0	1
	4	1	24	7	9	0	0	45

No. of misclassifications = 27 or 60%.

17b

2nd Test Graph \ 1st Test Graph.	1	2	3	
1	1	1	0	2
2	4	23	5	32
3	0	3	8	11
	5	27	13	45

No. of misclassifications = 13 or 28·89%.

18a 1st Physician's 2nd assessment of 1st Graph compared with 2nd Graph.

1st Test Graph \ 2nd Test Graph.	1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	2	0	19	5	4	0	3	33
4	1	0	1	2	1	0	0	5
5	0	0	2	0	1	0	1	4
6	0	0	0	0	2	0	0	2
8	0	0	1	0	0	0	0	1
	3	0	23	7	8	0	4	45

No. of misclassifications = 23 or 51·11%.

18b

1st Test Graph \ 2nd Test Graph.	1	2	3	
1	1	2	0	3
2	4	25	4	33
3	0	1	8	9
	5	28	12	45

No. of misclassifications = 11 or 23·33%.

19a 2nd Physician's 1st assessment of 1st Graph compared with 2nd Graph.

1st Test Graph \ 2nd Test Graph.	1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	11	8	5	0	2	26
4	0	0	5	3	1	0	1	10
5	0	0	3	0	1	0	2	6
6	0	0	0	0	1	0	0	1
8	0	0	1	0	0	0	1	2
	0	0	20	11	8	0	6	45

No. of misclassifications = 29 or 64·44%.

19b

1st Test Graph \ 2nd Test Graph.	1	2	3	
1	2	7	0	9
2	4	19	3	26
3	0	3	7	10
	6	29	10	45

No. of misclassifications = 17 or 37·78%.

20a

2nd Physician's 2nd assessment of 1st Graph compared with 2nd Graph.

1st Test Graph \ 2nd Test Graph.	1	2	3	4	5	6	8	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	14	1	5	0	0	20
4	0	0	8	4	0	0	1	13
5	0	0	3	1	6	0	0	10
6	0	0	0	0	1	0	0	1
8	0	0	0	0	0	0	1	1
	0	0	25	6	12	0	1	45

No. of misclassifications = 20 or 44·4%.

20b

1st Test Graph \ 2nd Test Graph.	1	2	3	
1	1	2	0	3
2	5	22	4	31
3	0	5	6	11
	6	29	10	45

No. of misclassifications = 16 or 35·67%.

TABLES CALCULATED FROM 1b to 20b BY COMBINING CATEGORIES.

Degrees of freedom = 1 in all tables.

1c

22	1	23
9	28	37
31	29	60

$\chi^2 = 28 \cdot 896$
p = ·001
C = ·57

2c

23	4	27
2	31	33
25	35	60

$\chi^2 = 38 \cdot 251$
p = ·001
C = ·62

3c

20	6	26
2	32	34
22	38	60

$\chi^2 = 43 \cdot 455$
p = ·001
C = ·65

4c

23	1	24
7	29	36
30	30	60

$\chi^2 = 33 \cdot 611$
p = ·001
C = ·6

5c

21	3	24
1	35	36
22	38	60

$\chi^2 = 44 \cdot 15$
p = ·001
C = ·65

6c

24	3	27
6	27	33
30	30	60

$\chi^2 = 29 \cdot 696$
p = ·001
C = ·58

7c

7	7	14
2	14	16
9	21	30

$\chi^2 = 5$
p = ·05
C = ·38

8c

13	1	14
2	14	16
15	15	30

$\chi^2 = 19{\cdot}286$
p = ·001
C = ·63

9c

10	3	13
4	13	17
14	16	30

$\chi^2 = 8{\cdot}439$
p = ·01
C = ·45

10c

9	4	13
3	14	17
12	18	30

$\chi^2 = 8{\cdot}167$
p = ·01
C = ·46

11c

64	2	66
3	21	24
67	23	90

$\chi^2 = 65{\cdot}6$
p = ·001
C = ·65

12c

68	2	70
2	18	20
70	20	90

$\chi^2 = 68{\cdot}345$
p = ·001
C = ·66

13c

69	5	74
1	15	16
70	20	90

$\chi^2 = 57 \cdot 602$
p = ·001
C = ·62

14c

65	5	70
2	18	20
67	23	90

$\chi^2 = 56 \cdot 134$
p = ·001
C = ·62

15c

65	4	69
0	21	21
65	25	90

$\chi^2 = 71 \cdot 217$
p = ·001
C = ·66

16c

66	4	70
1	19	20
67	23	90

$\chi^2 = 50 \cdot 14$
p = ·001
C = ·6

17c

29	5	34
3	8	11
32	13	45

$\chi^2 = 14 \cdot 076$
p = ·001
C = ·49

18c

32	4	36
1	8	9
33	12	45

$\chi^2 = 22 \cdot 273$
p = ·001
C = ·58

19c

32	3	35
3	7	10
35	10	45

$\chi^2 = 16 \cdot 981$
$p = \cdot 001$
$C = \cdot 52$

20c

30	4	34
5	6	11
35	10	45

$\chi^2 = 8 \cdot 8$
$p = \cdot 01$
$C = \cdot 4$

APPENDIX 3.

DEPRESSIVES.

1st Physician's 1st Assessment of 1st Graph compared with 2nd Graph.

1. One day interval: misclassification = 70%.
2. Three day interval: " = 66·67%.

1st Physician's 2nd Assessment of 1st Graph compared with 2nd Graph.

1. One day interval: misclassification = 60%.
2. Three day interval: " = 66·67%.

2nd Physician's 1st Assessment of 1st Graph compared with 2nd Graph.

1. One day interval: misclassification = 60%.
2. Three day interval: " = 70·33%.

2nd Physician's 2nd Assessment of 1st Graph compared with 2nd Graph.

1. One day interval: misclassification = 40%.
2. Three day interval: " = 66·67%.

APPENDIX 3.

SCHIZOPHRENICS.

1st Physician's 1st Assessment of 1st Graph compared with 2nd Graph.

1. One day interval: misclassification = 46.67%.
2. Three day interval: " = 66.67%.
3. Fourteen day interval: " = 66.67%.

1st Physician's 2nd Assessment of 1st Graph compared with 2nd Graph.

1. One day interval: misclassification = 46.67%.
2. Three day interval: " = 66.67%.
3. Fourteen day interval: " = 40%.

2nd Physician's 1st Assessment of 1st Graph compared with 2nd Graph.

1. One day interval: misclassification = 60%.
2. Three day interval: " = 80%.
3. Fourteen day interval: " = 60%.

2nd Physician's 2nd Assessment of 1st Graph compared with 2nd Graph.

1. One day interval: misclassification = 40%.
2. Three day interval: " = 60%.
3. Fourteen day interval: " = 40%.

APPENDIX IV

FUNKENSTEIN TEST.

Record of Blood Pressure.

Name. Age. Sex Code No.

Hosp. & No. Date.

Relation to treatment.

Preliminary recordings (at least 5 mins. ½-1 min. intervals)

											Mean of last 5.	

A. I.V. l-adrenaline 0.025 mgms. (½ min.intervals for 2 mins)

Time_____

Time + 3 mins._____ 5 mins_____ +7 mins_____

B. I.M. Amechol 10 mgms.
(½ min. intervals for 7 mins)

Time_____

(1 min. intervals)

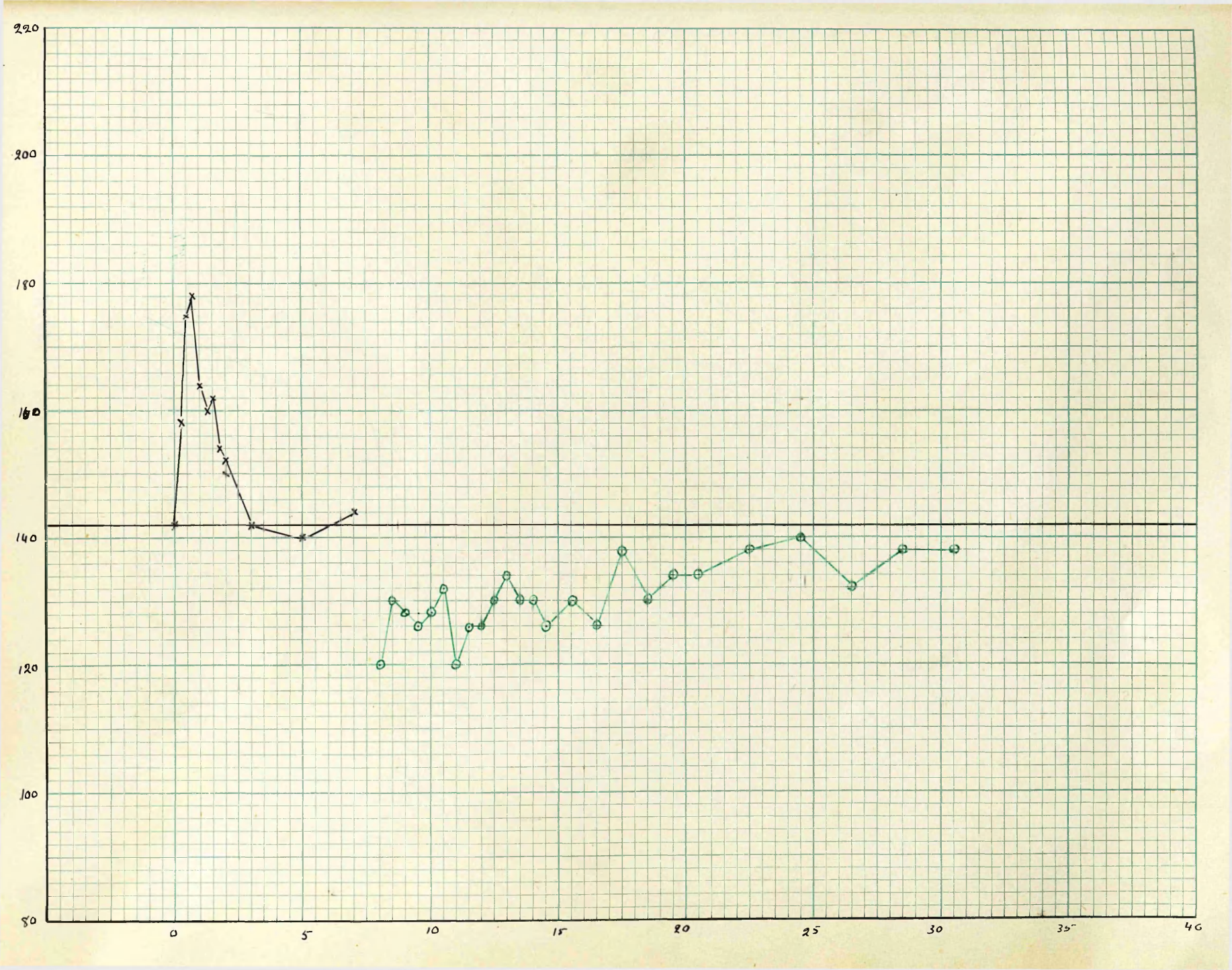
Time + 7_____

(2 min. intervals)

Time + 13_____

. . . . . .

DEPRESSIVE PATIENTS TESTED FOR THE FIRST TIME.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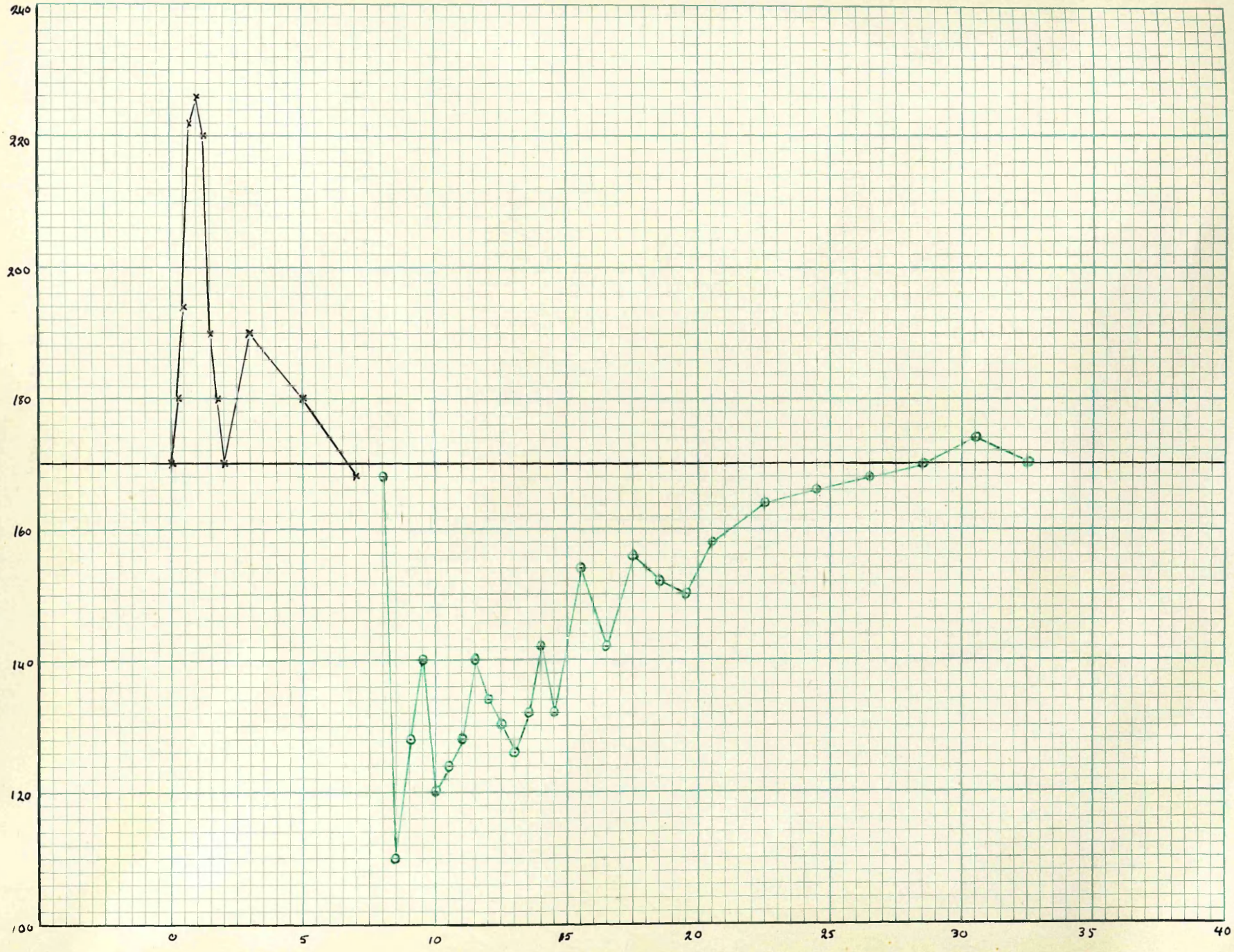
WORSFOLD AT DAY 0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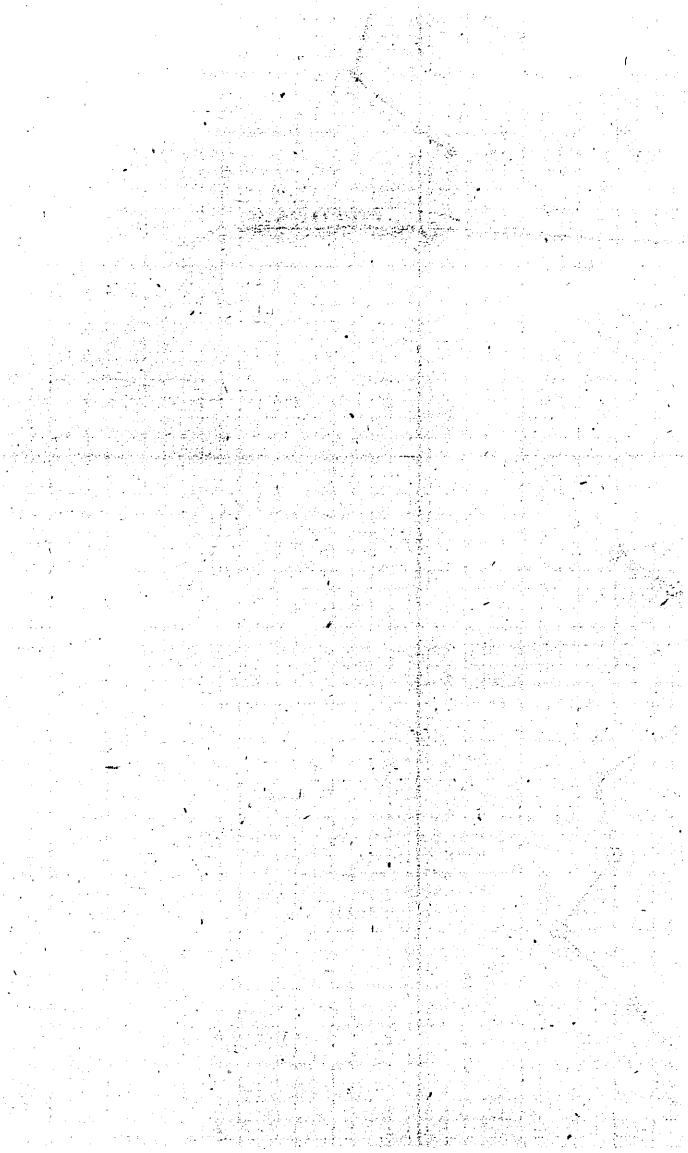
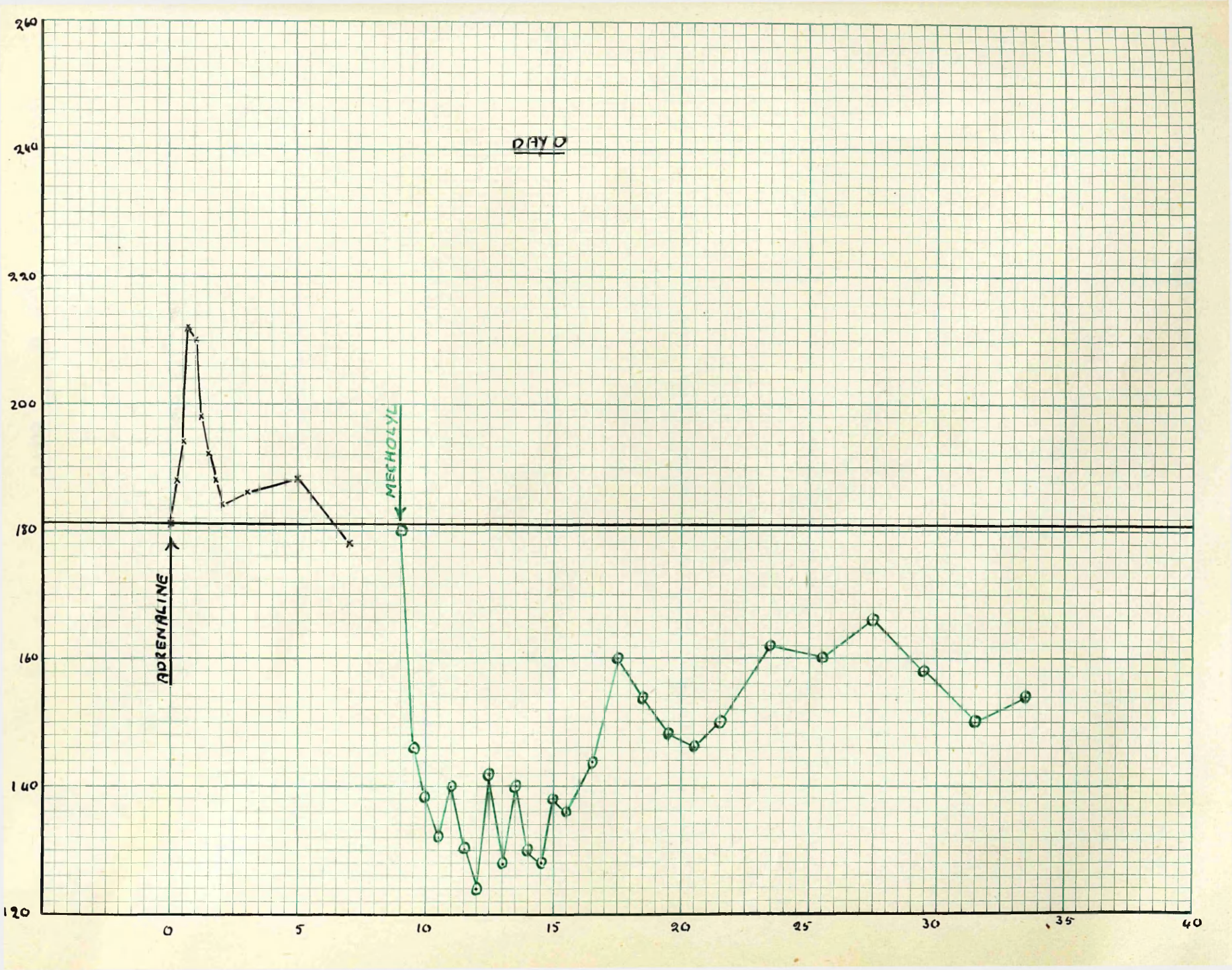
0030 GILL A BAYO

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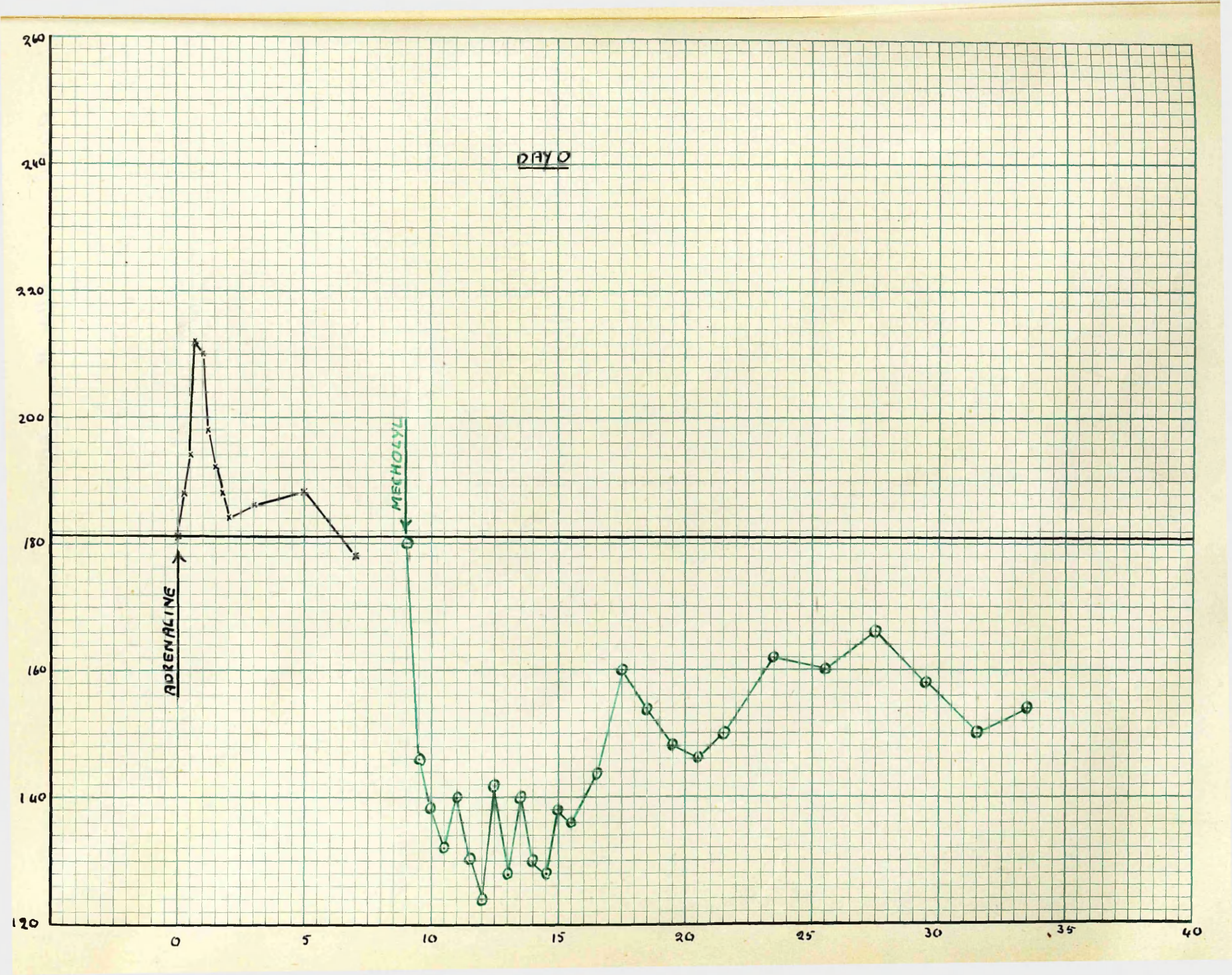
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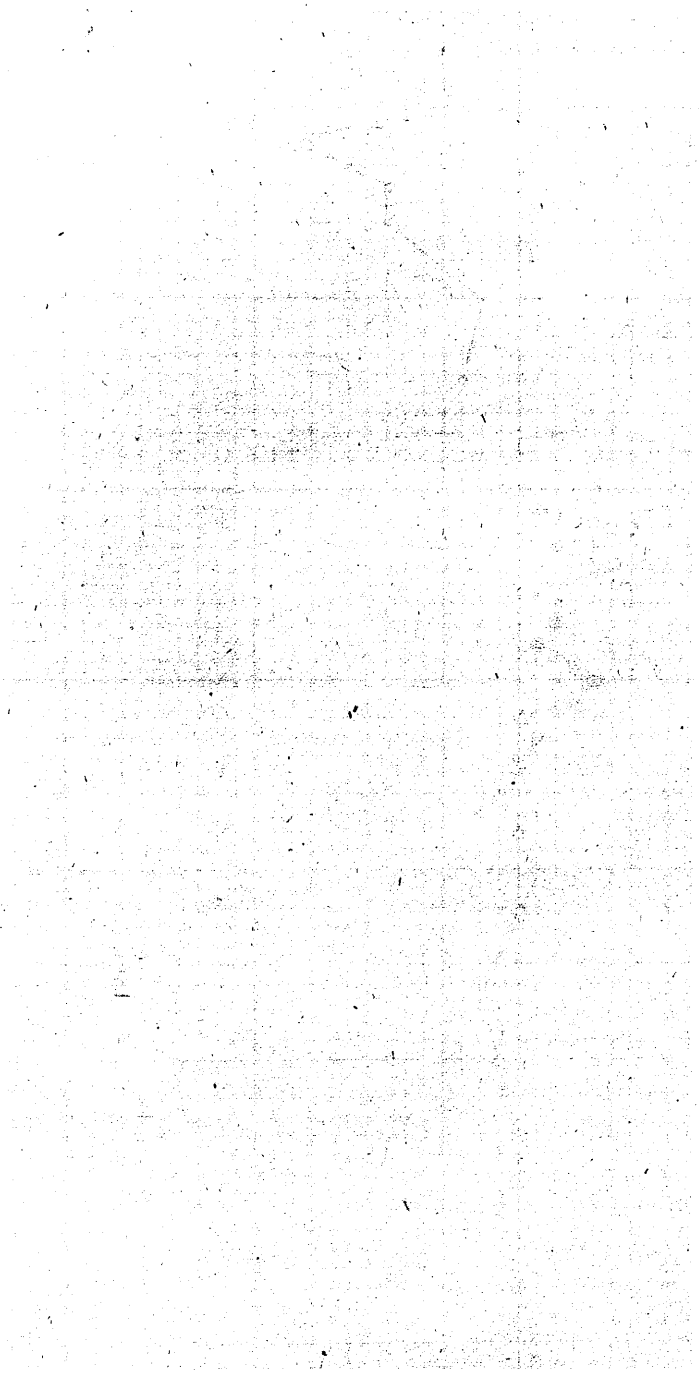

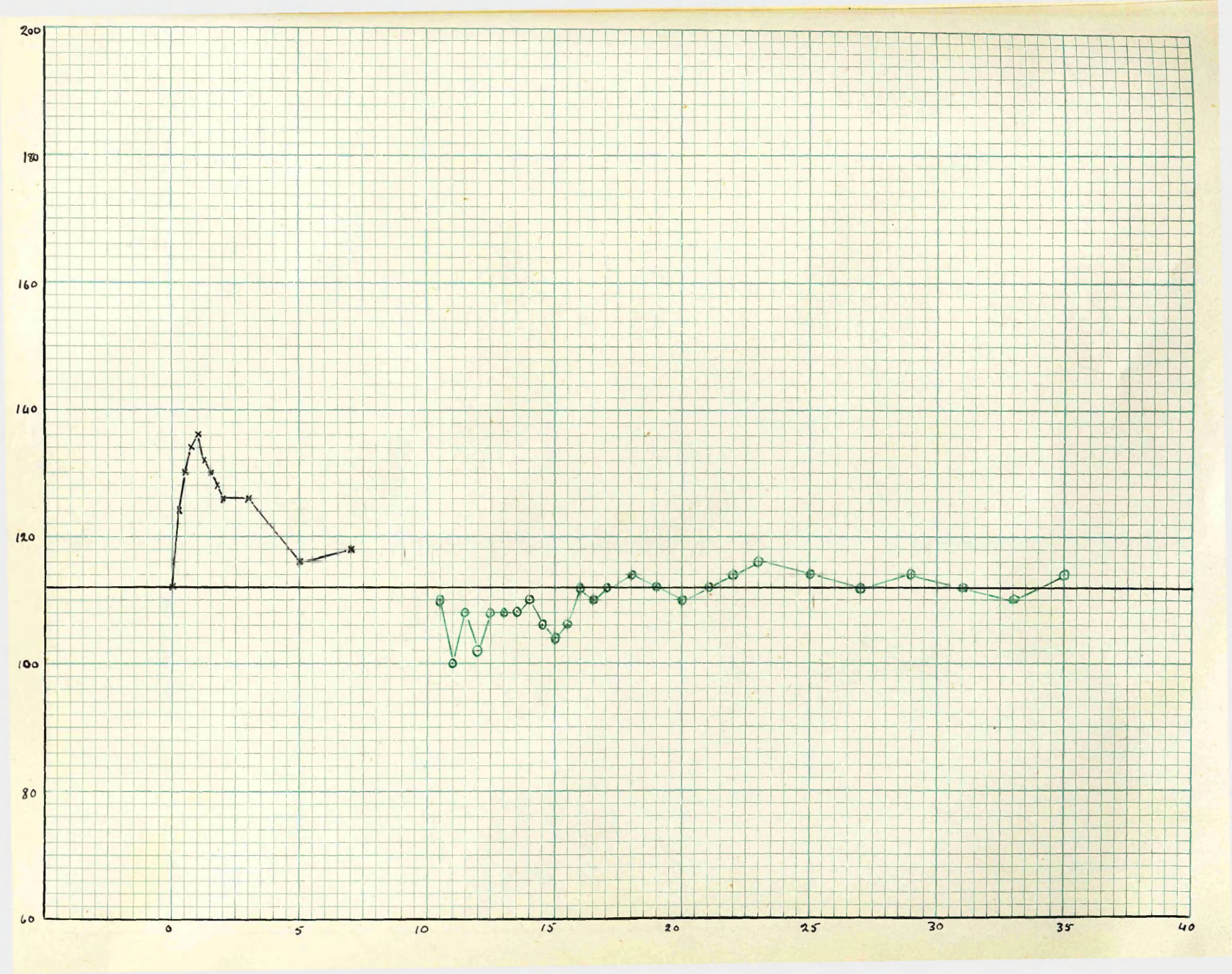
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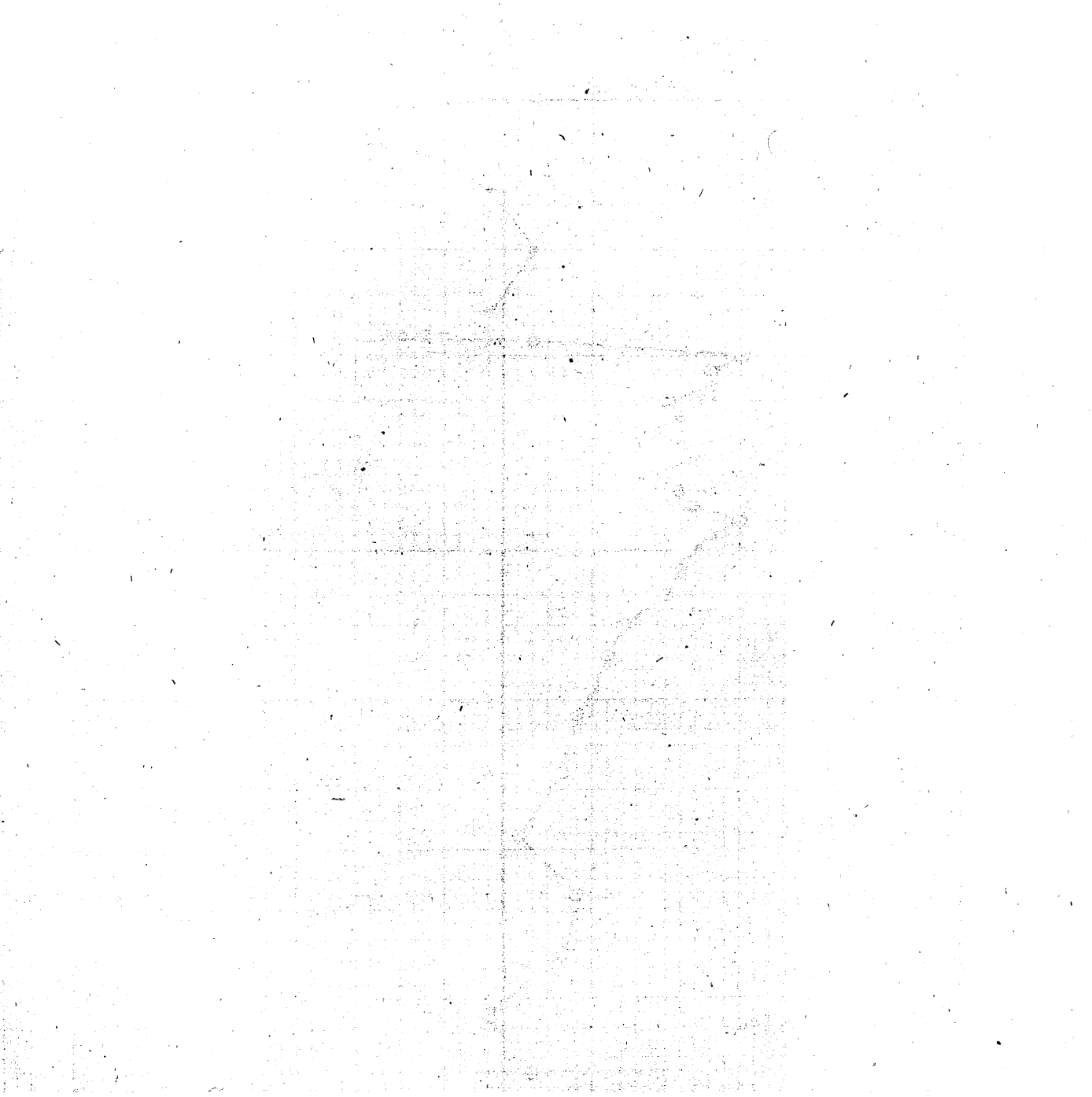

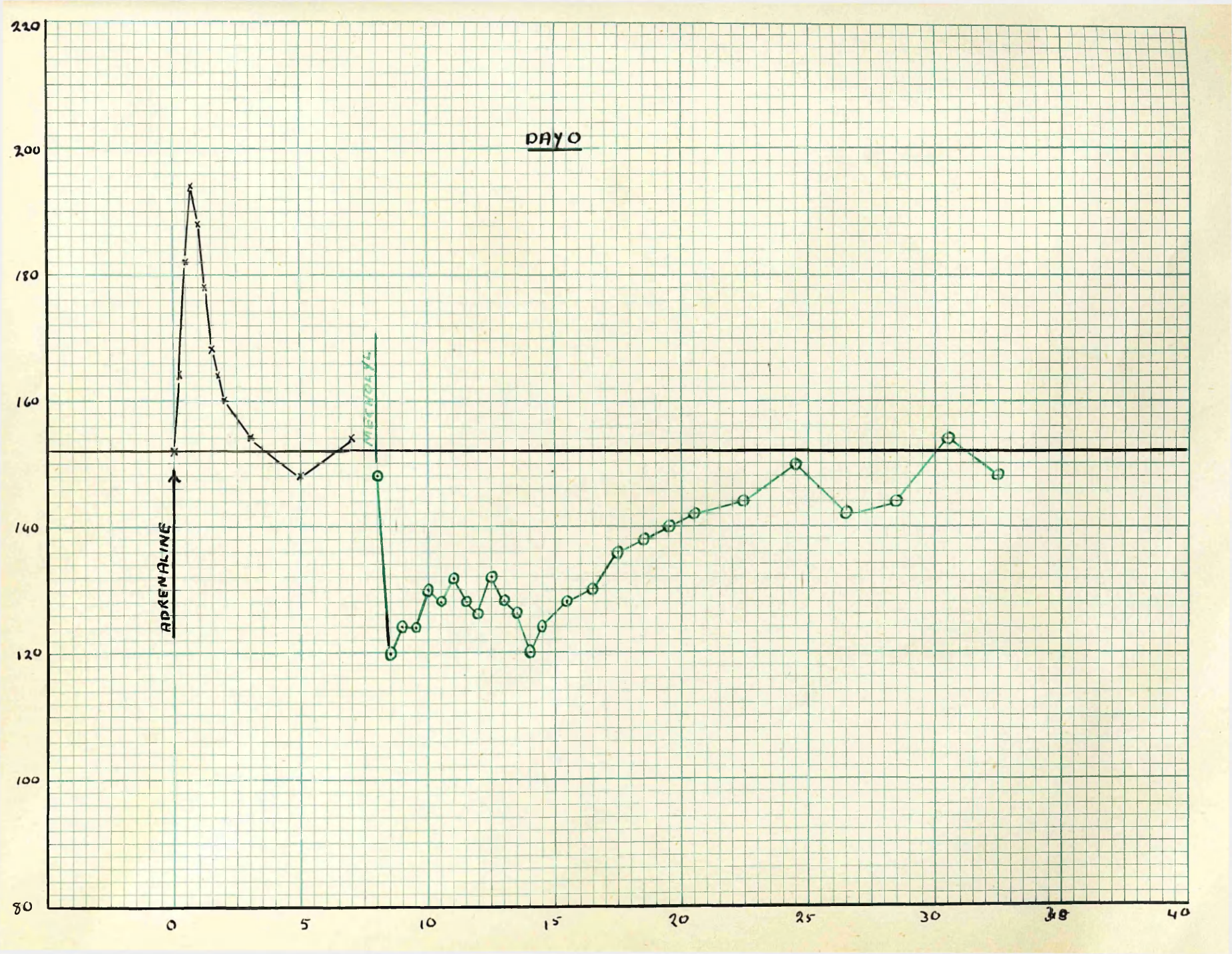
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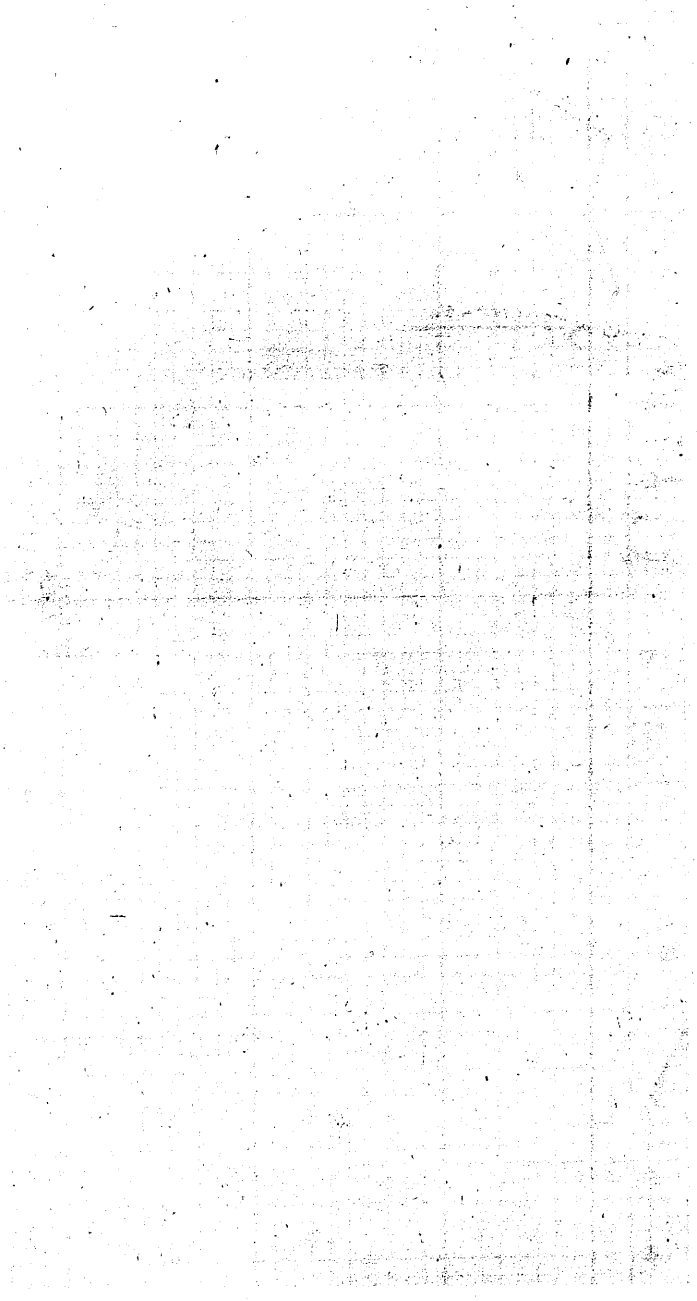

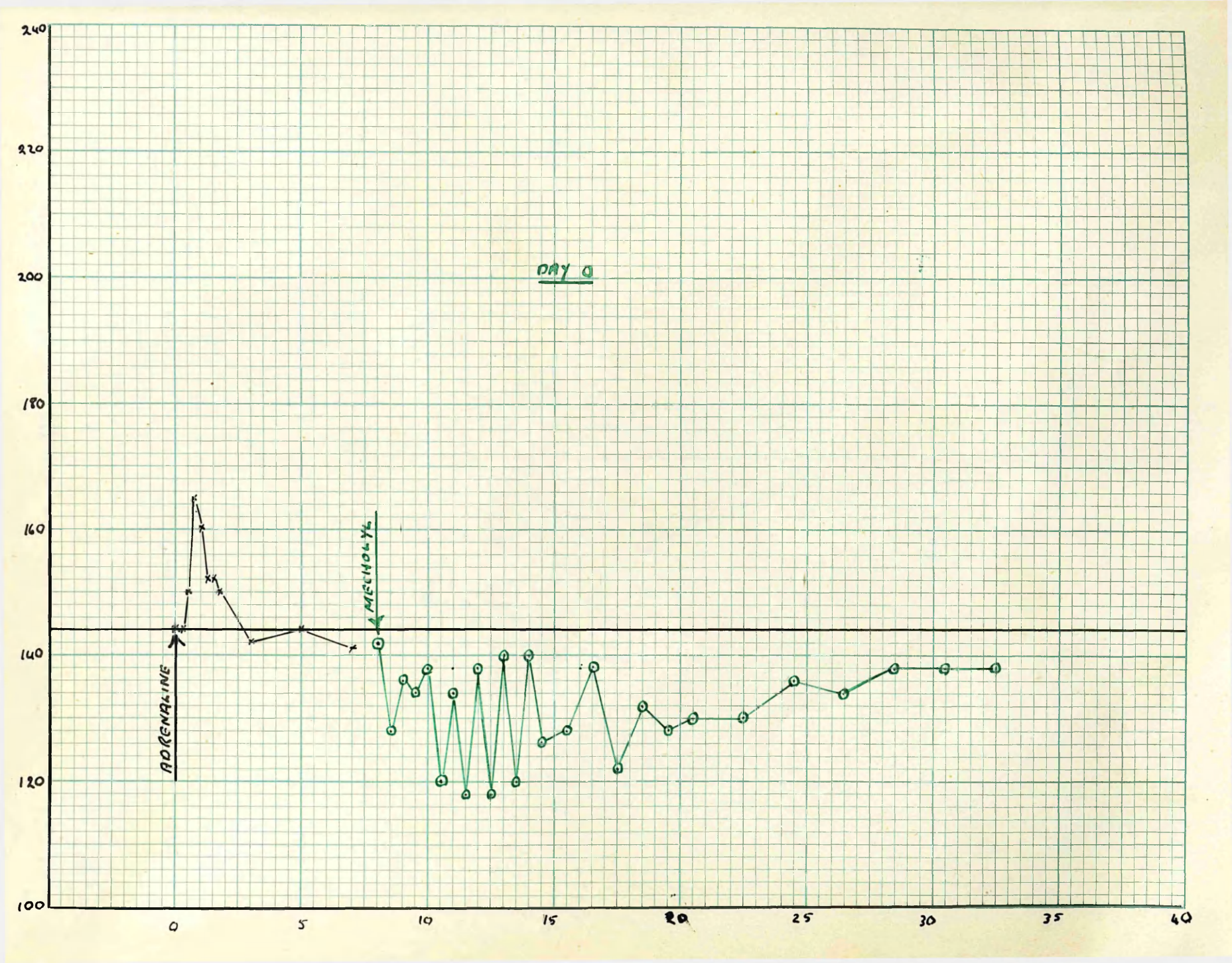
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MECHOLYL

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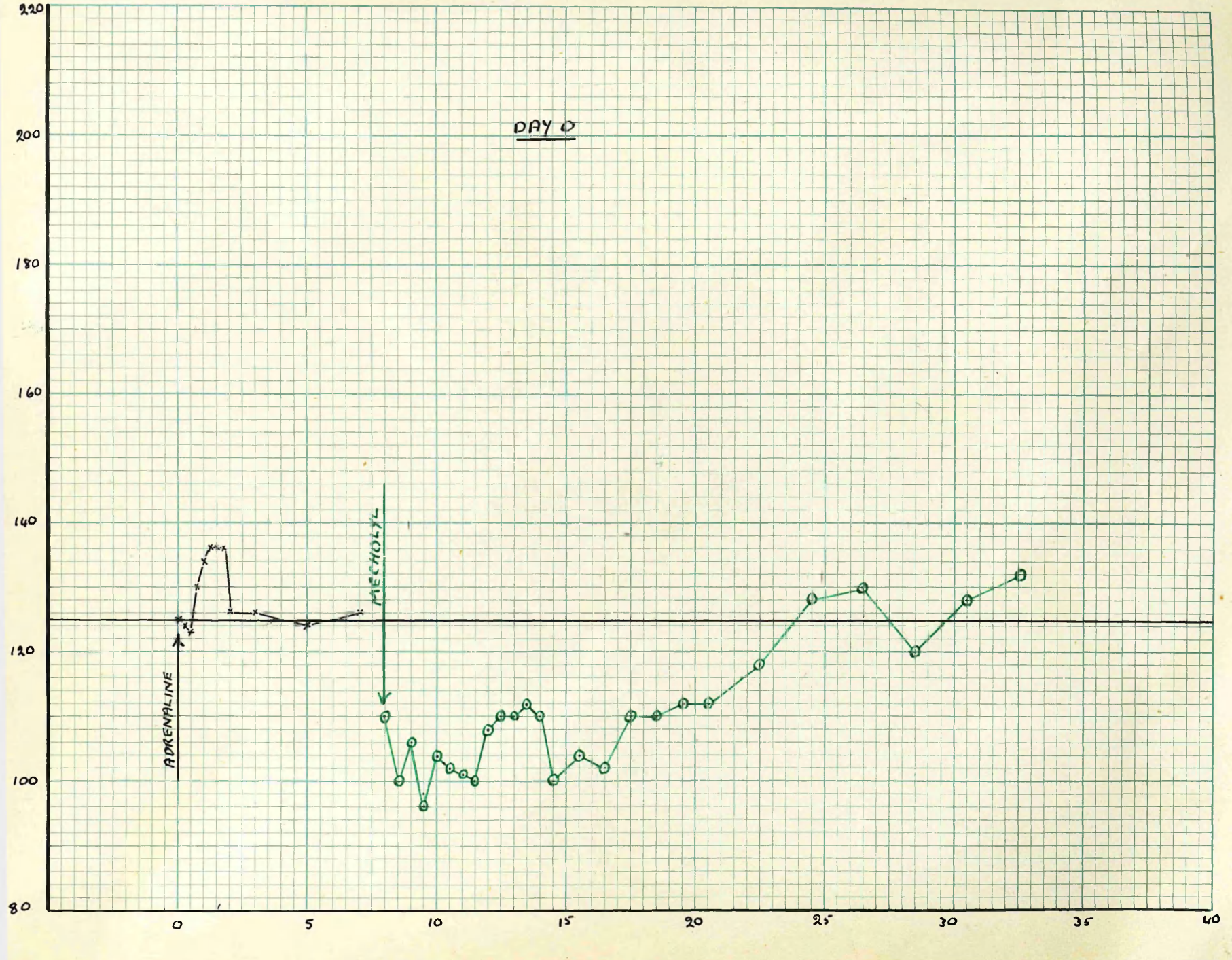
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ADRENALINE
MECHOLYL

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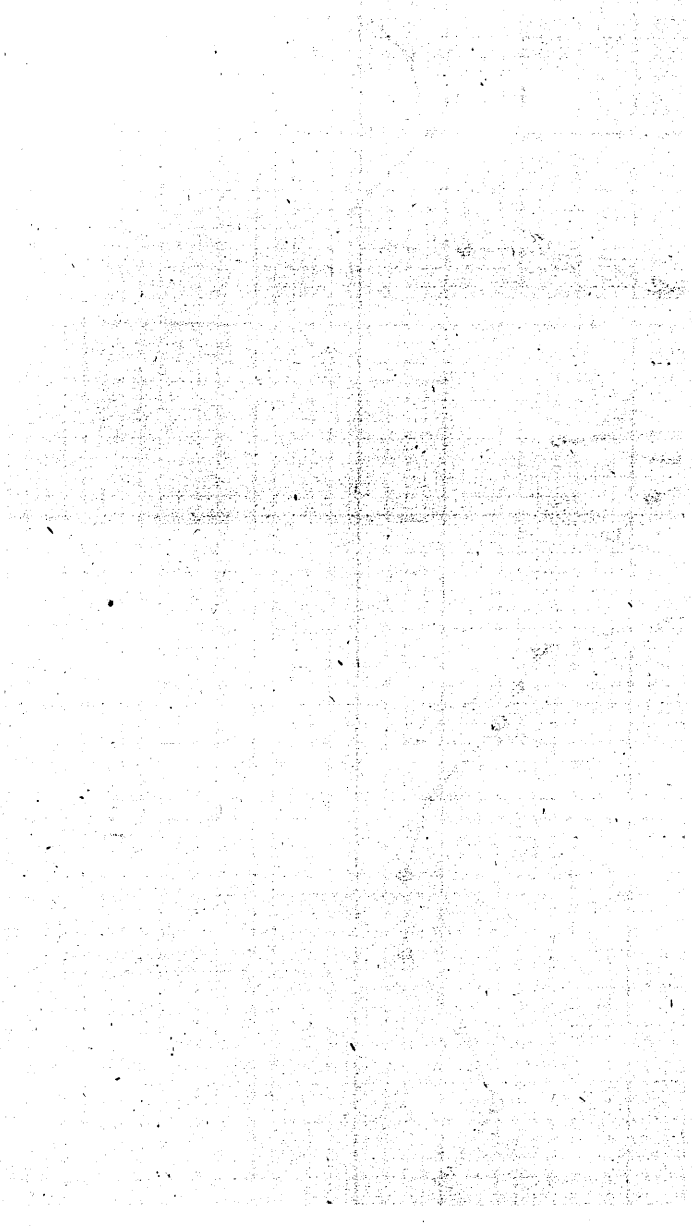

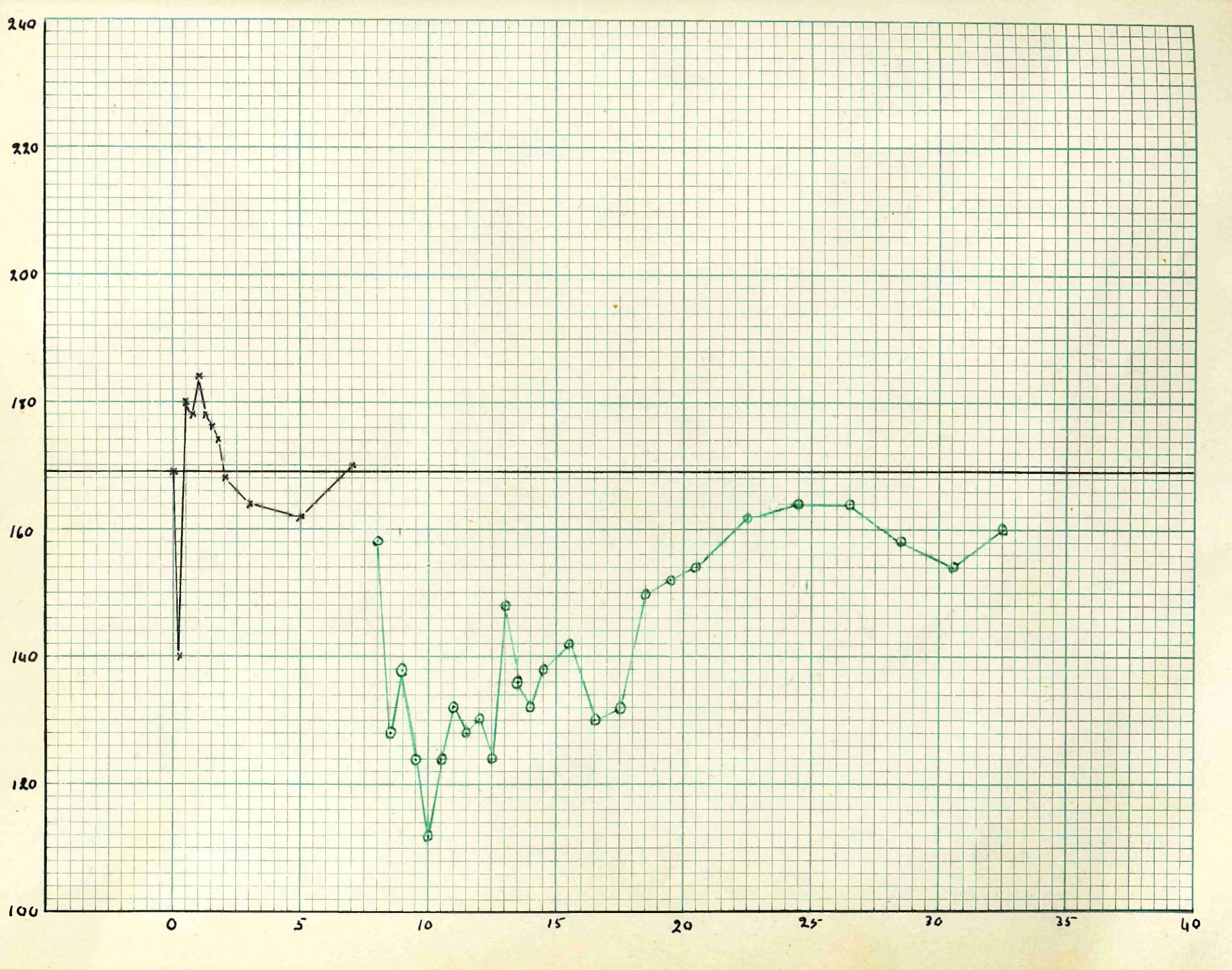
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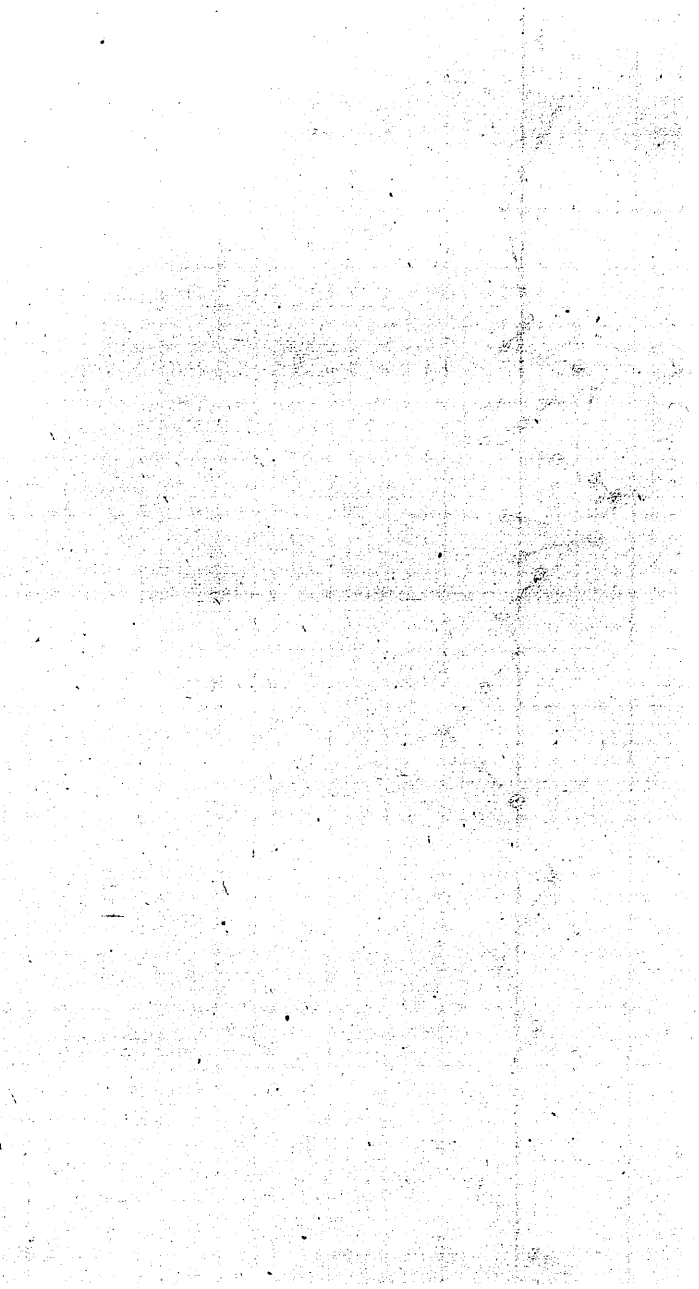

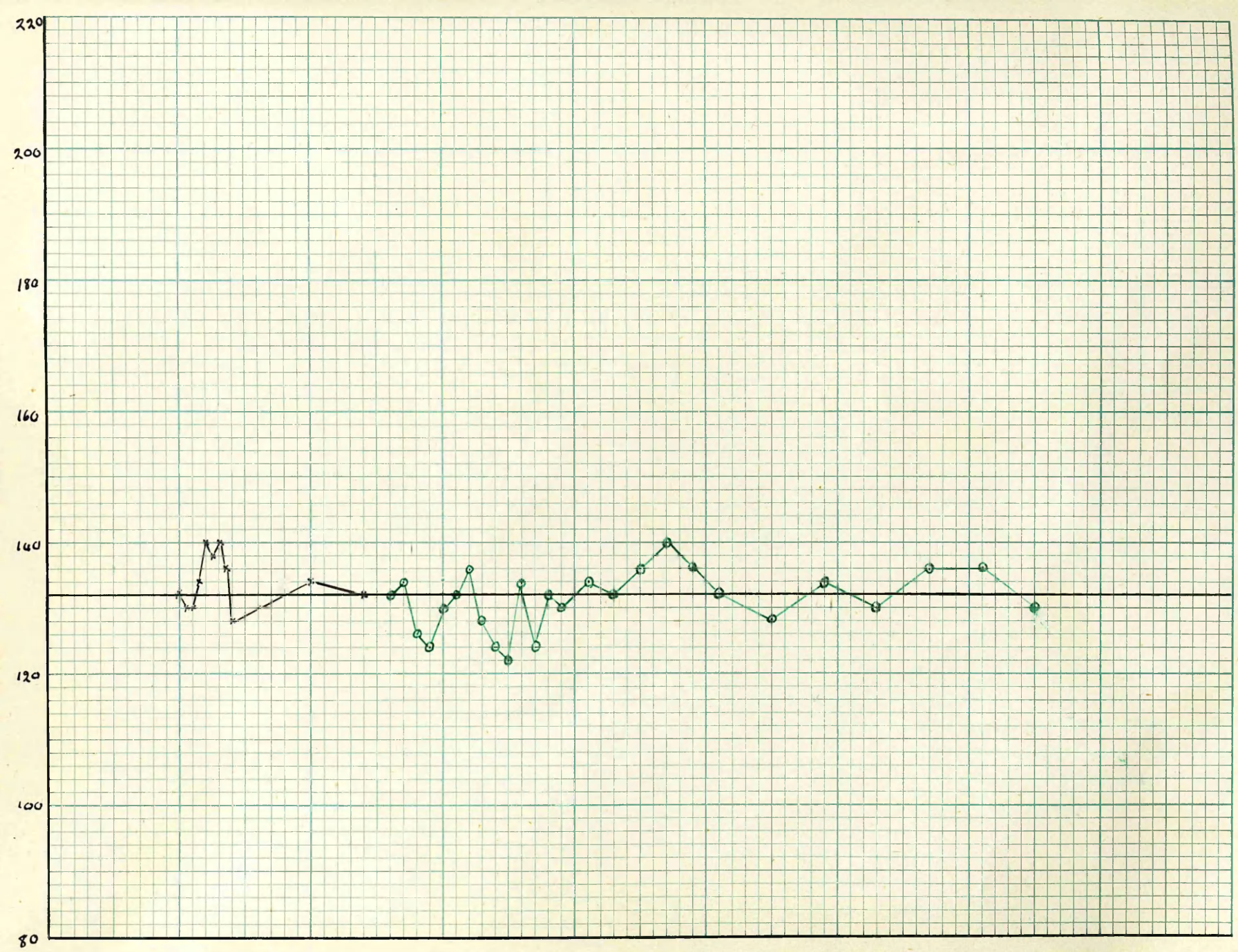
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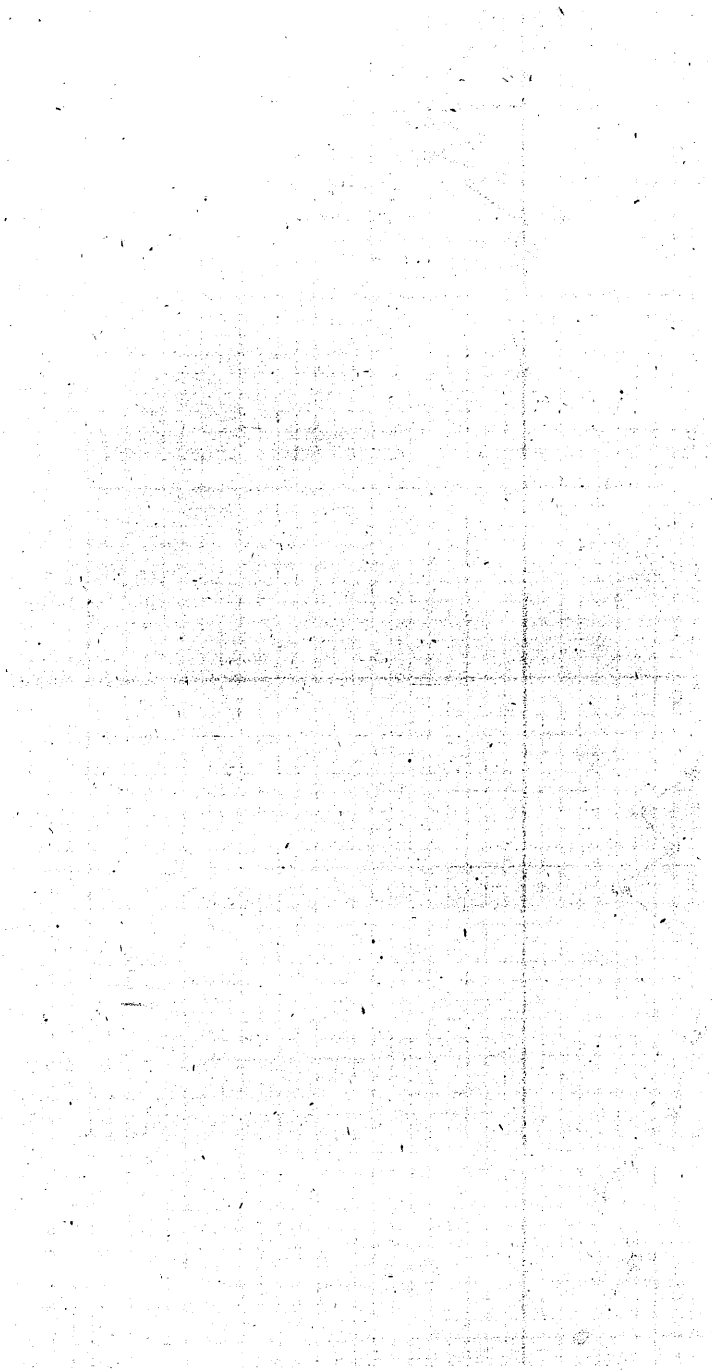

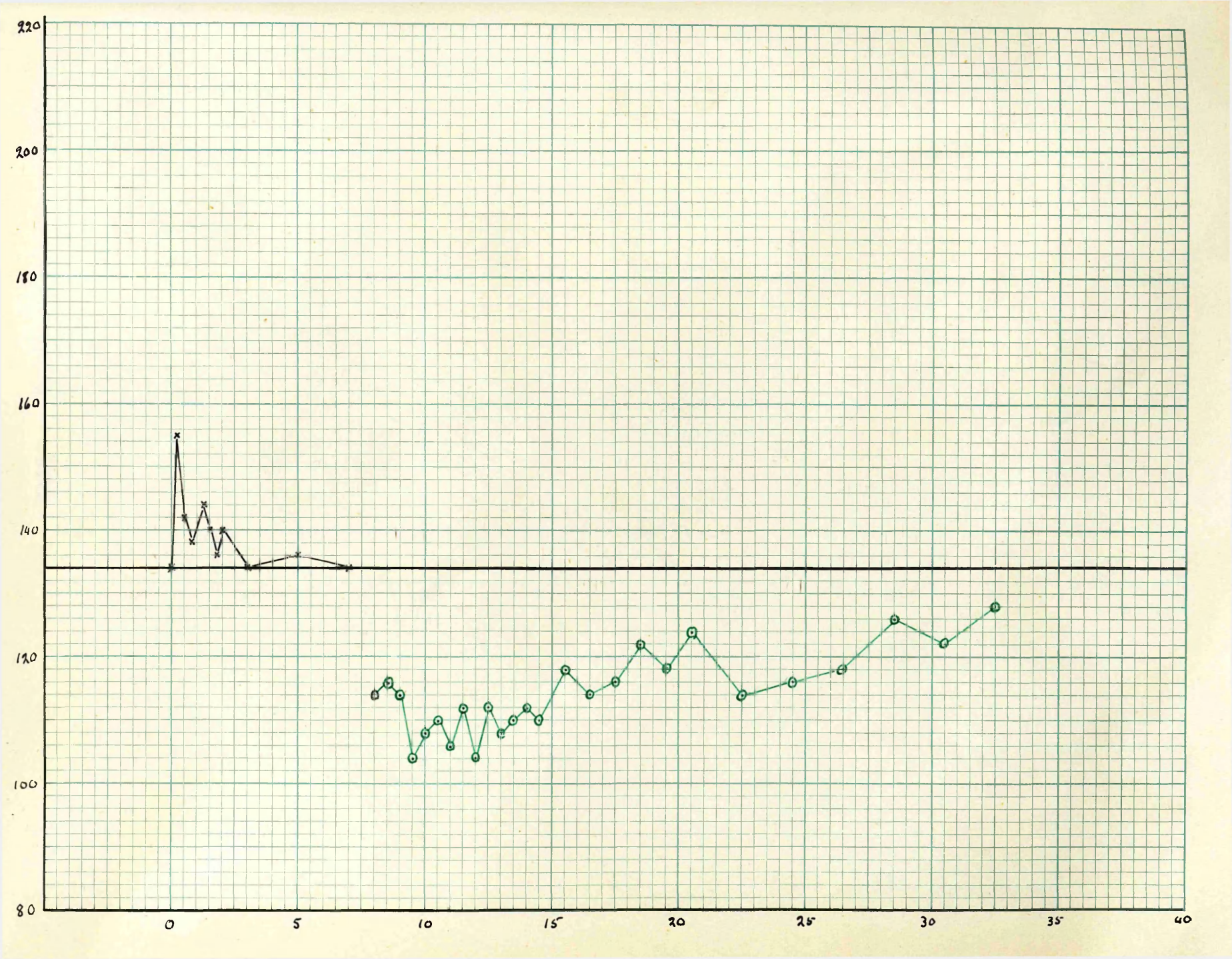
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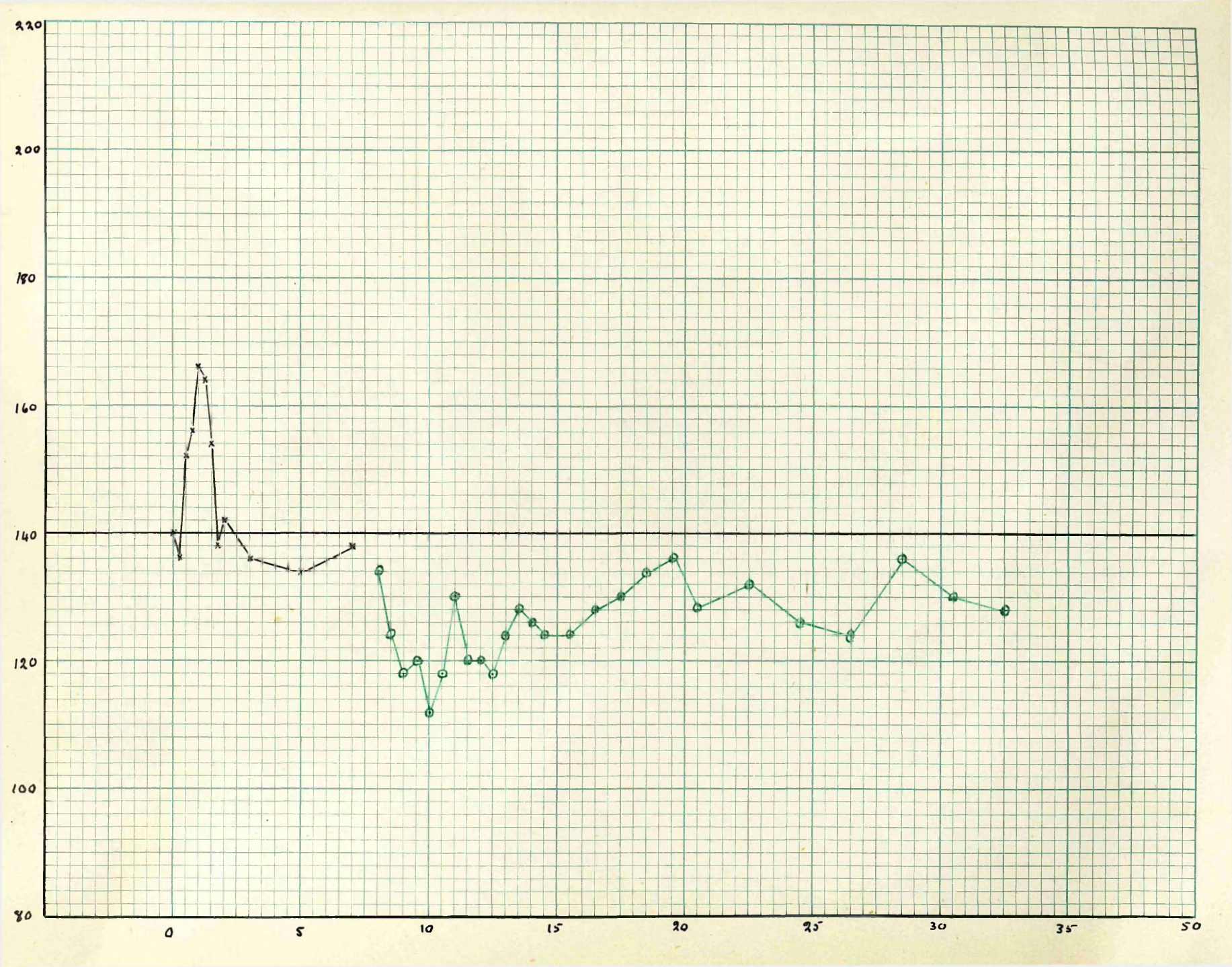
0110 FRANCIS JH DAY 0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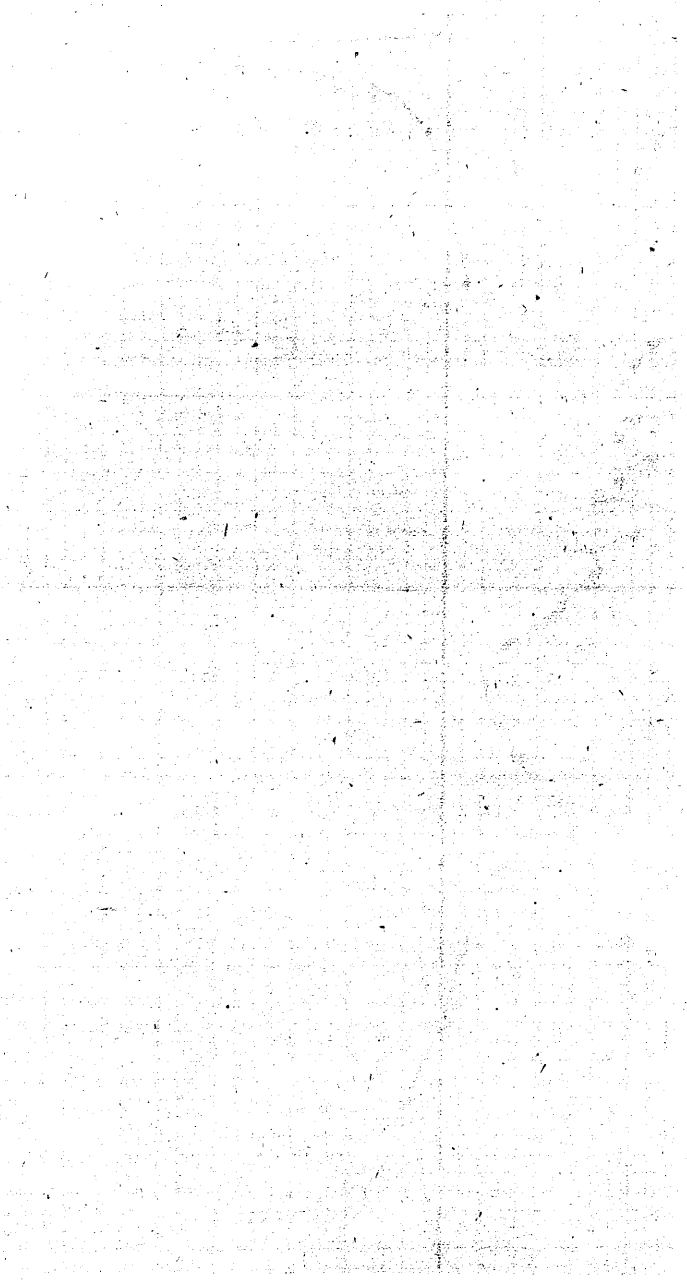
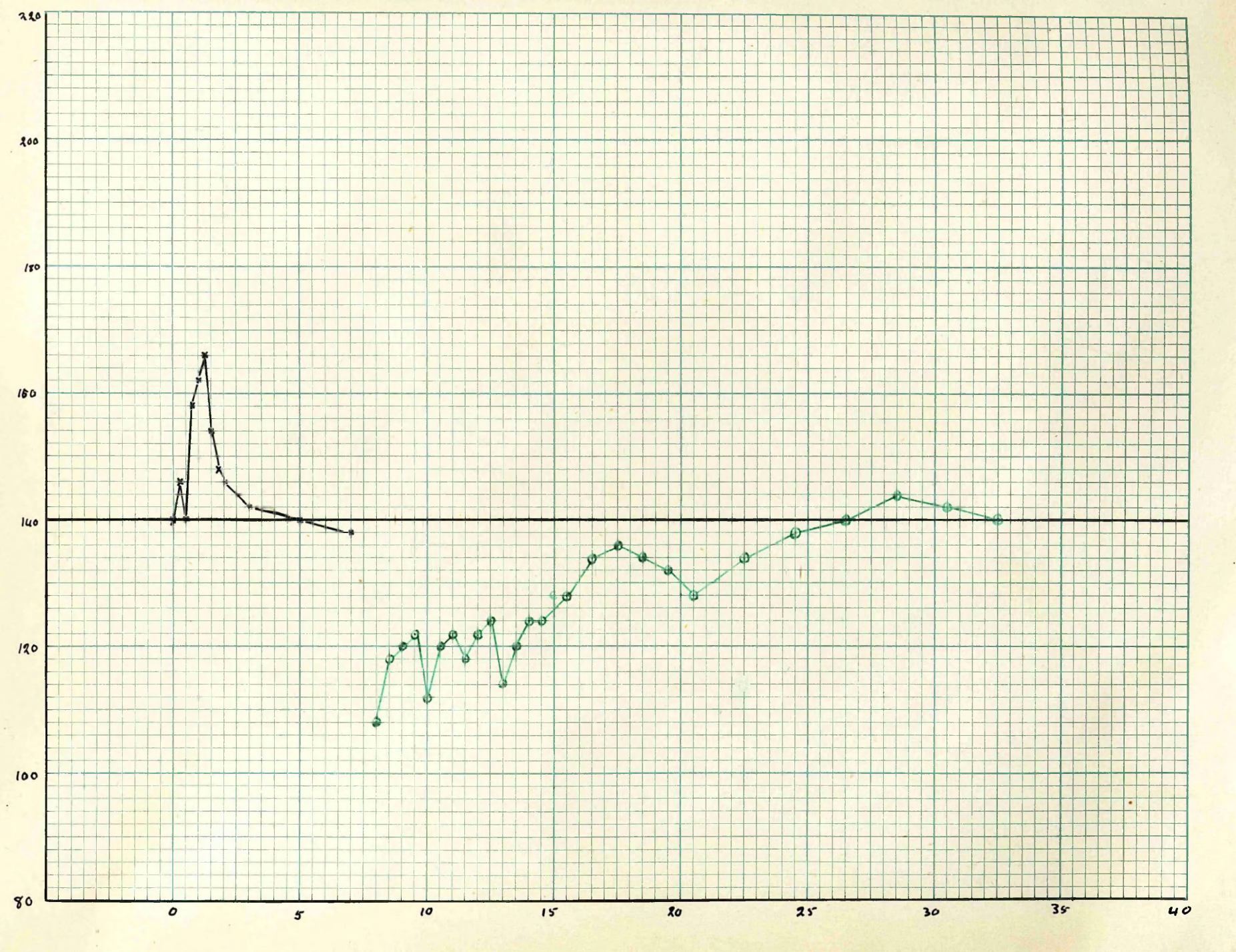
0120 CARLIN RP DAY 0

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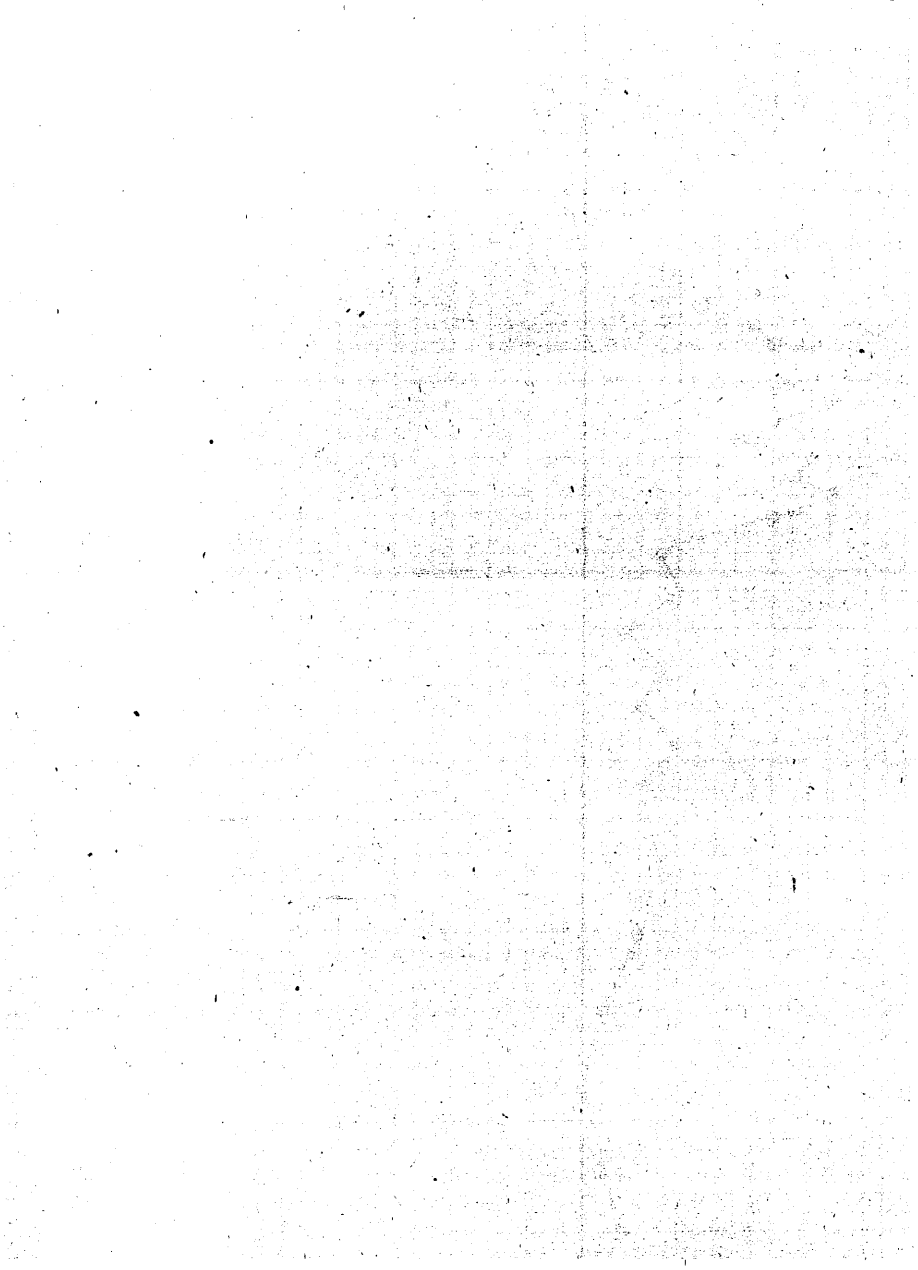

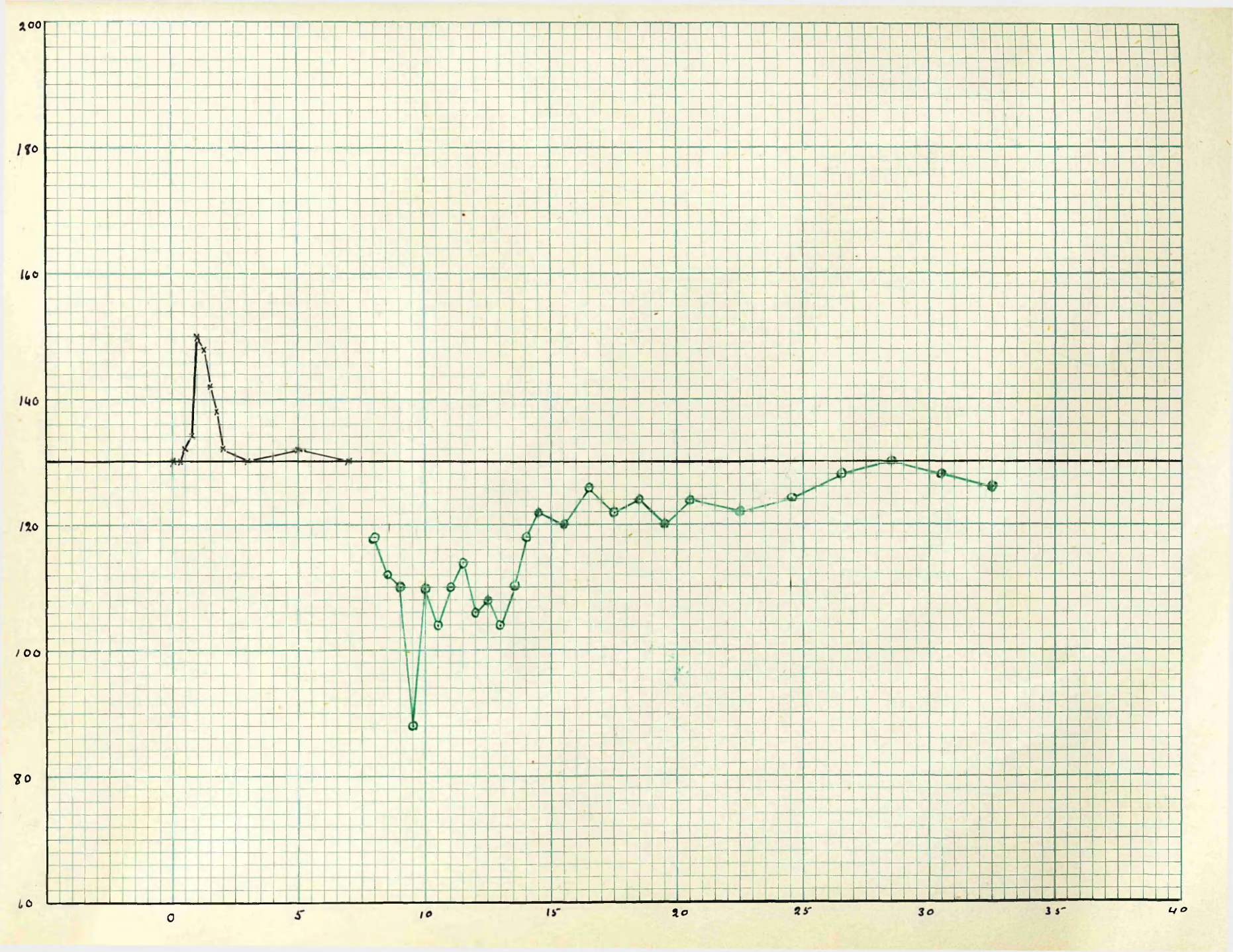
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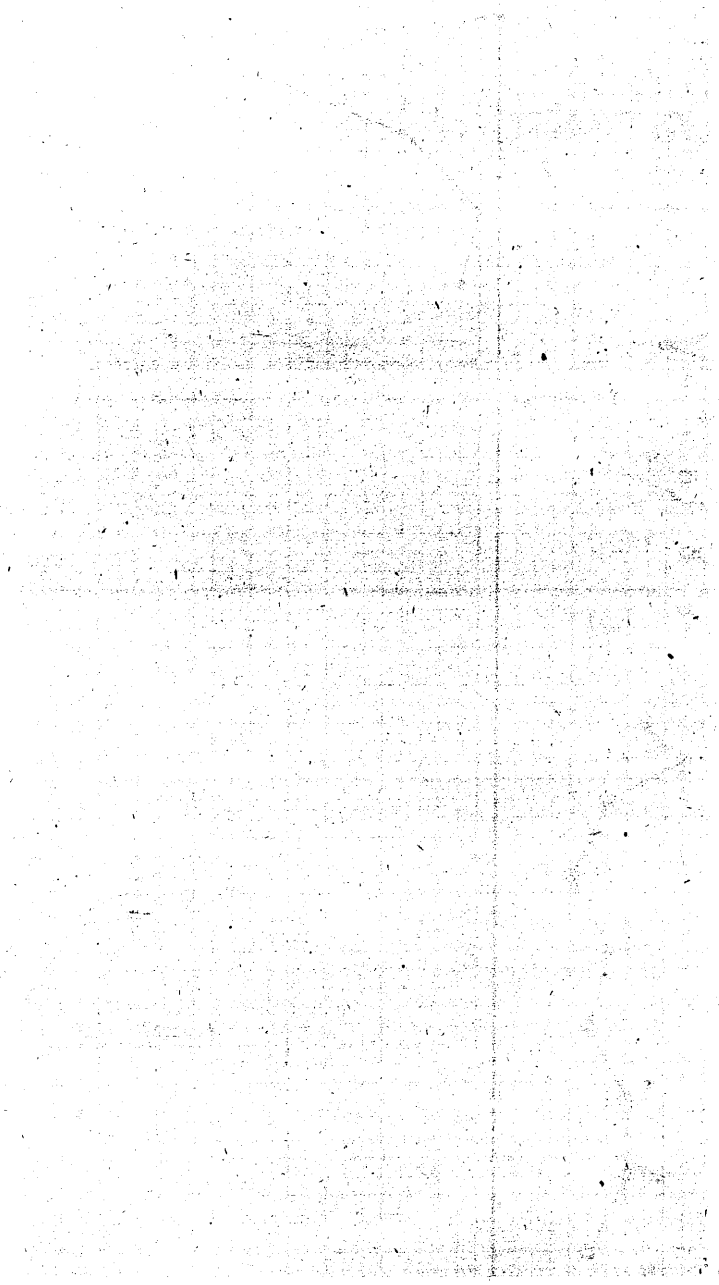
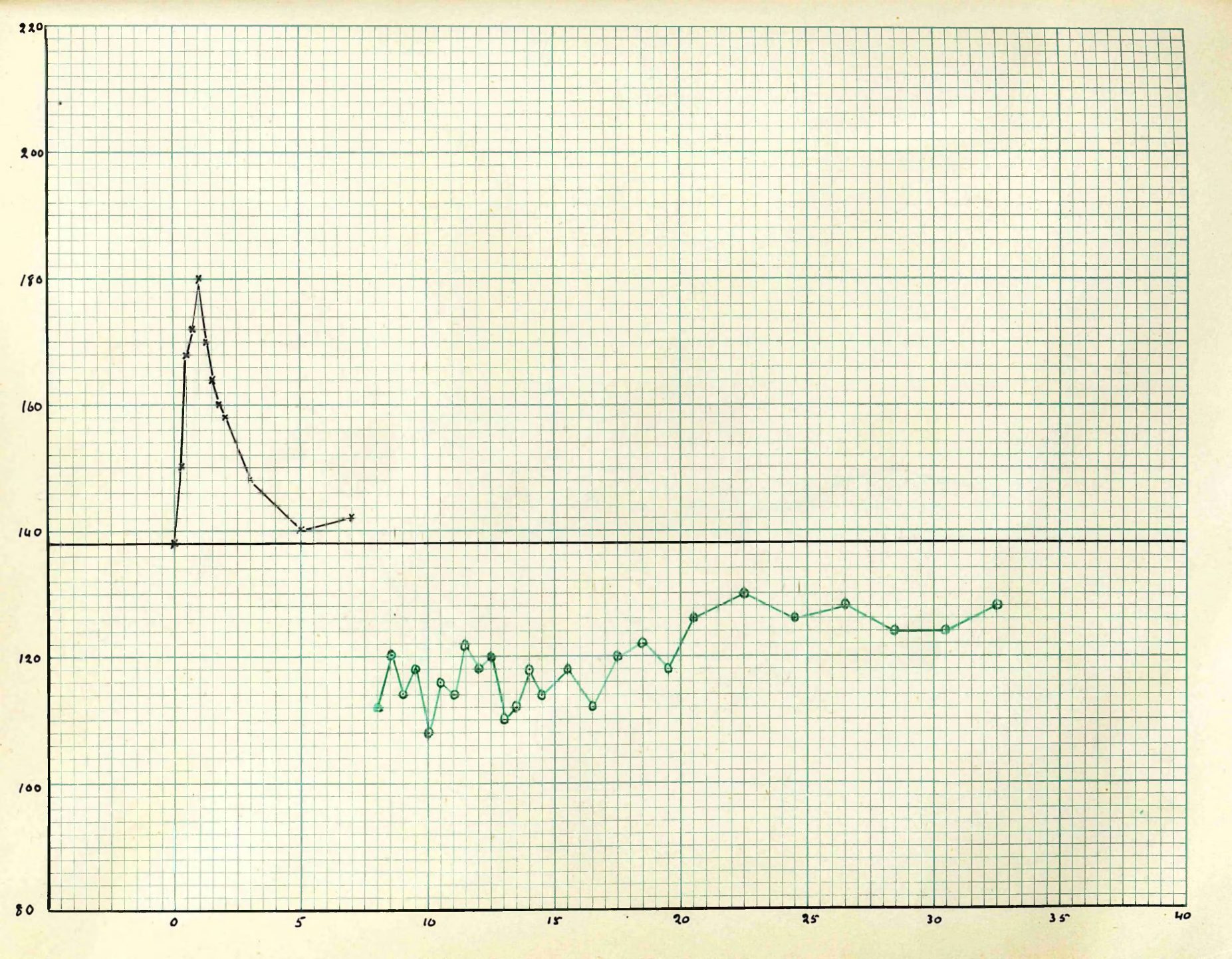
0140 ROTHWELL R. DAY O.

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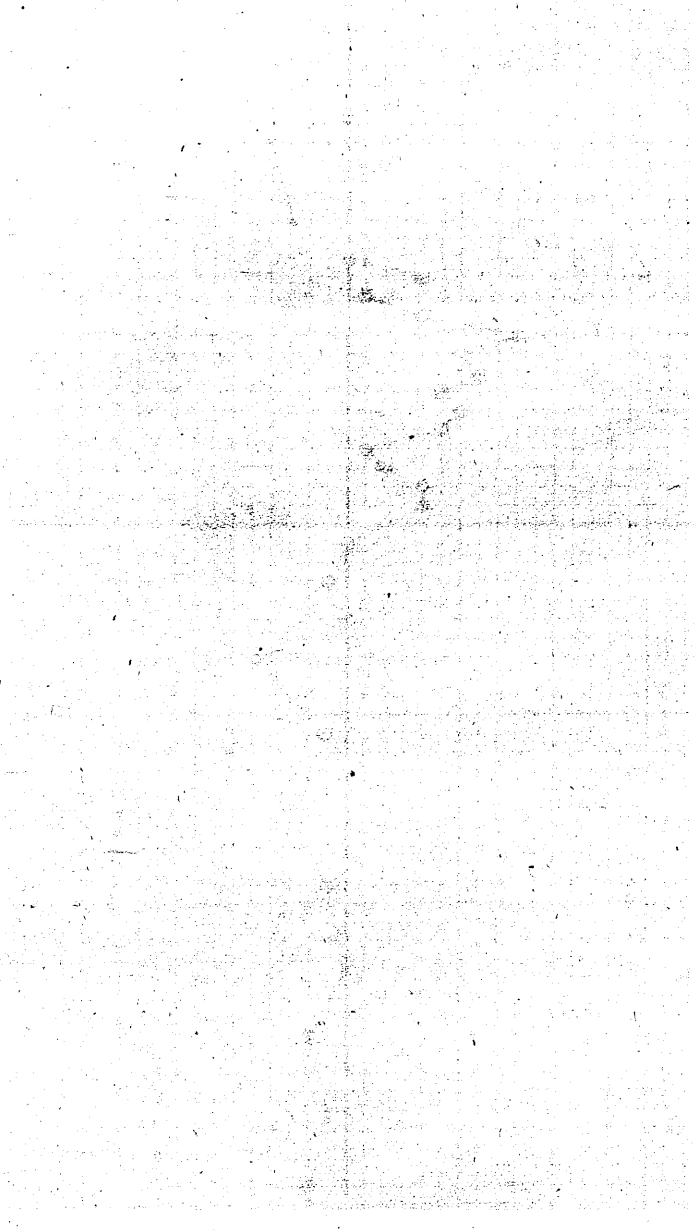
0150 FRANCIS H C DAY O

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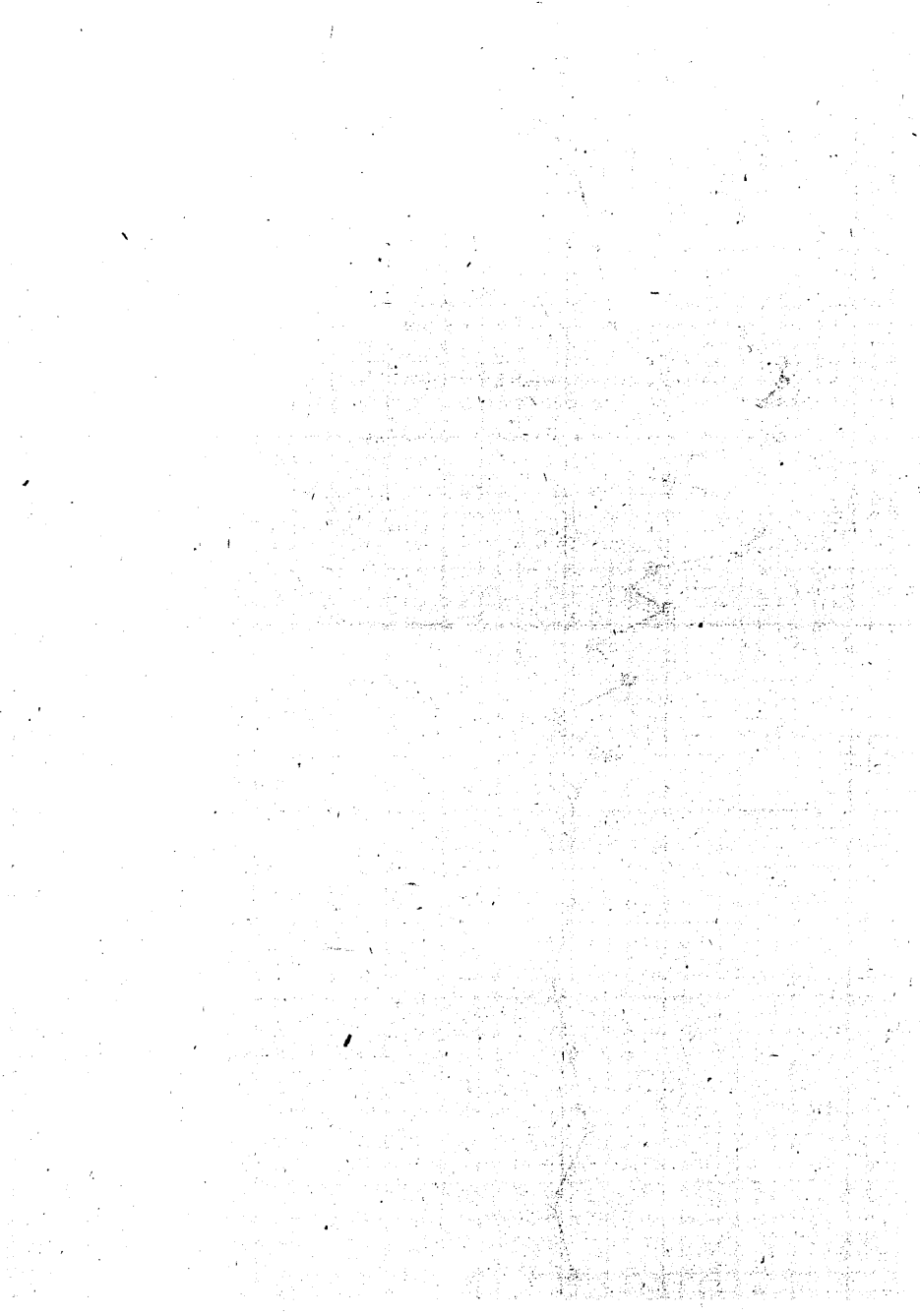
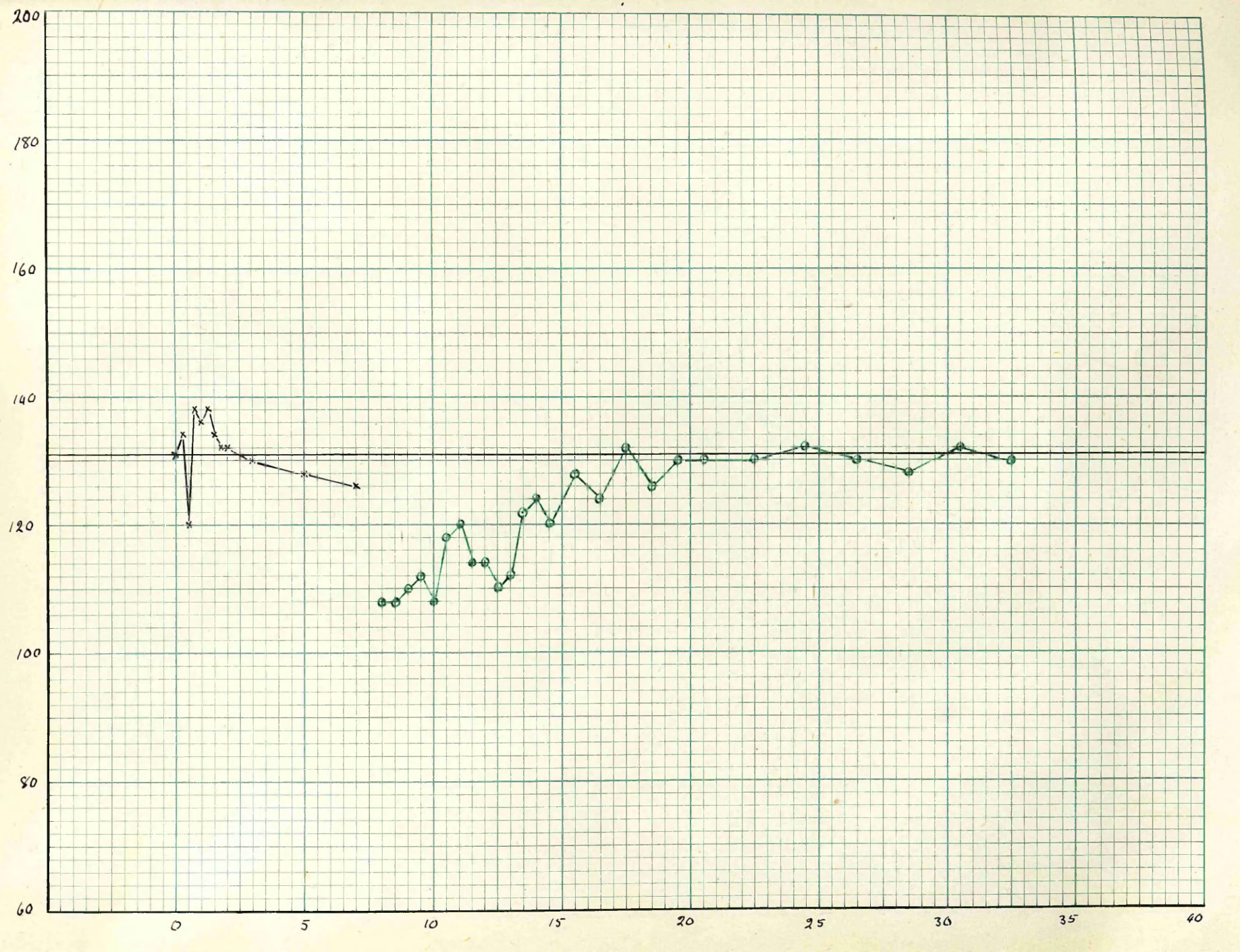
0160 STANLEY WOOD DAY 0

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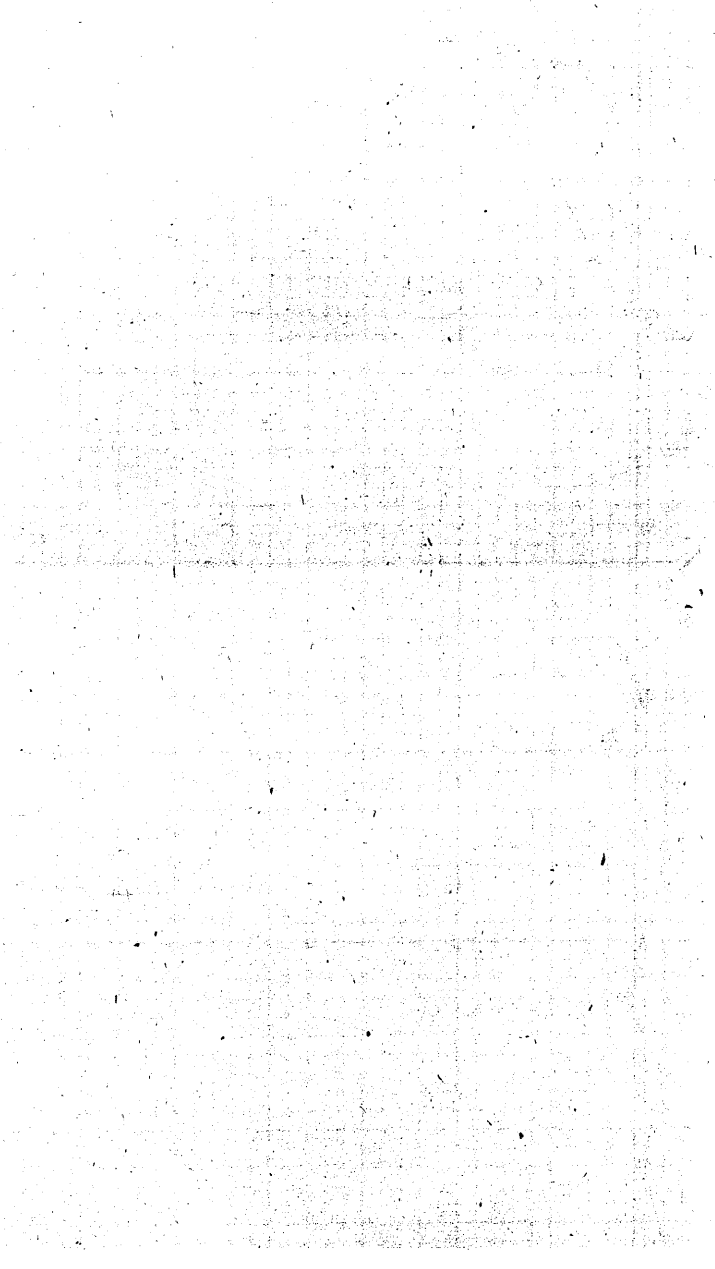
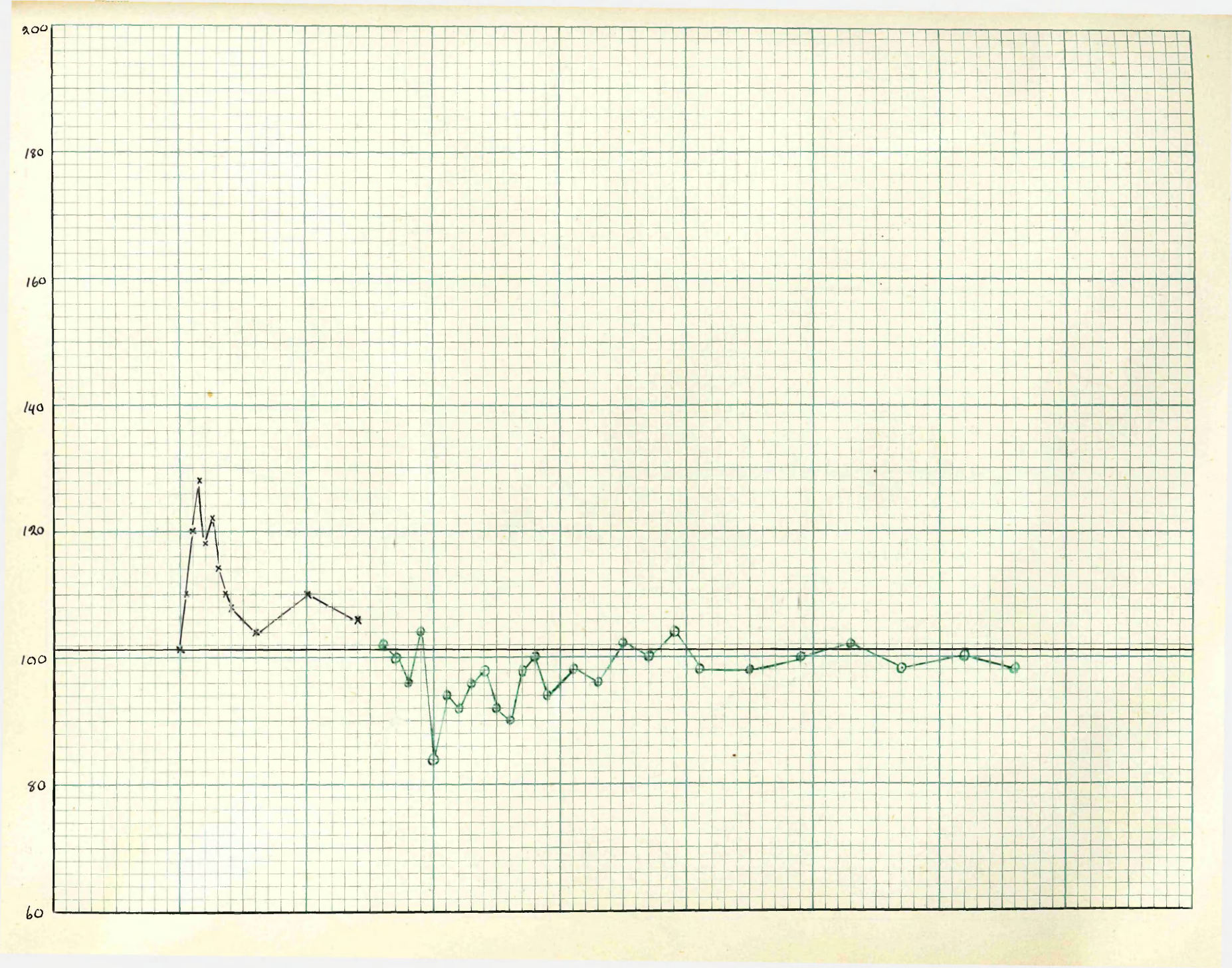
0170 SCOTT H. DAYO

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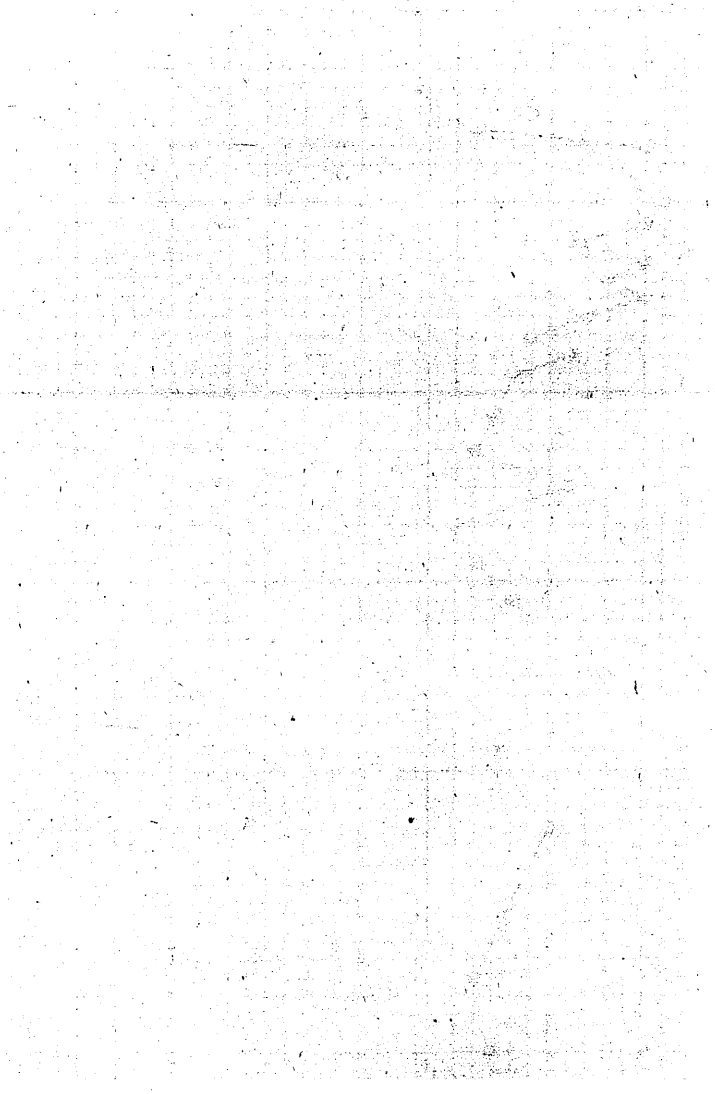
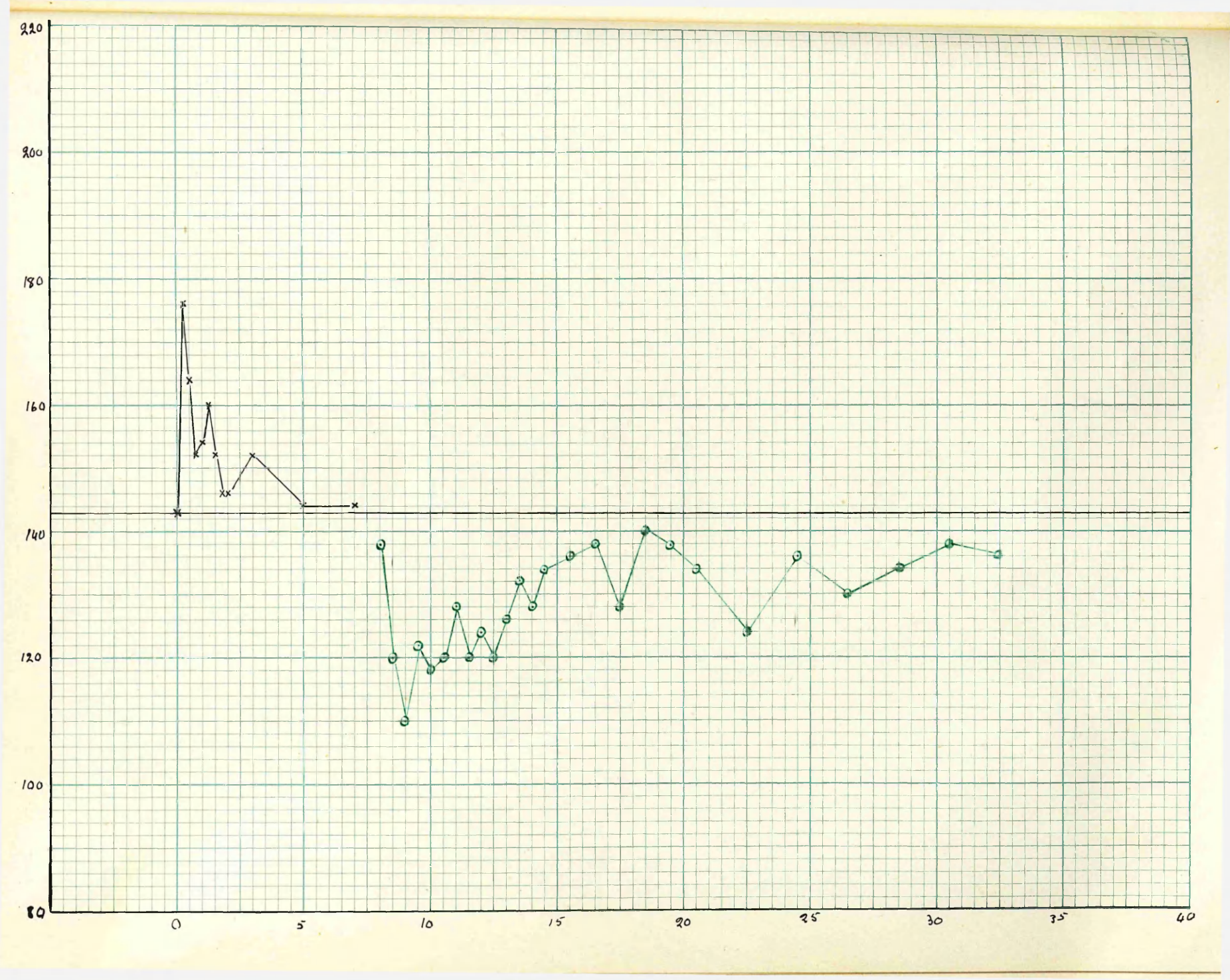
0180 FISHER WT DAY 0

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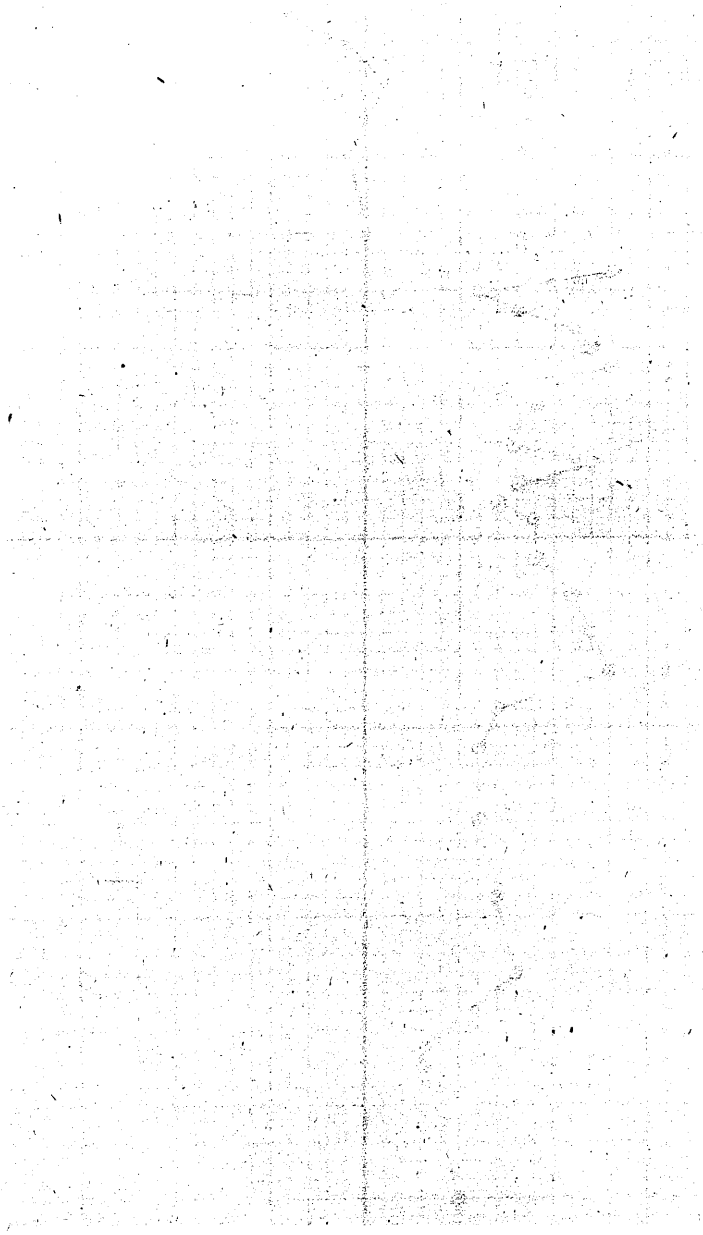

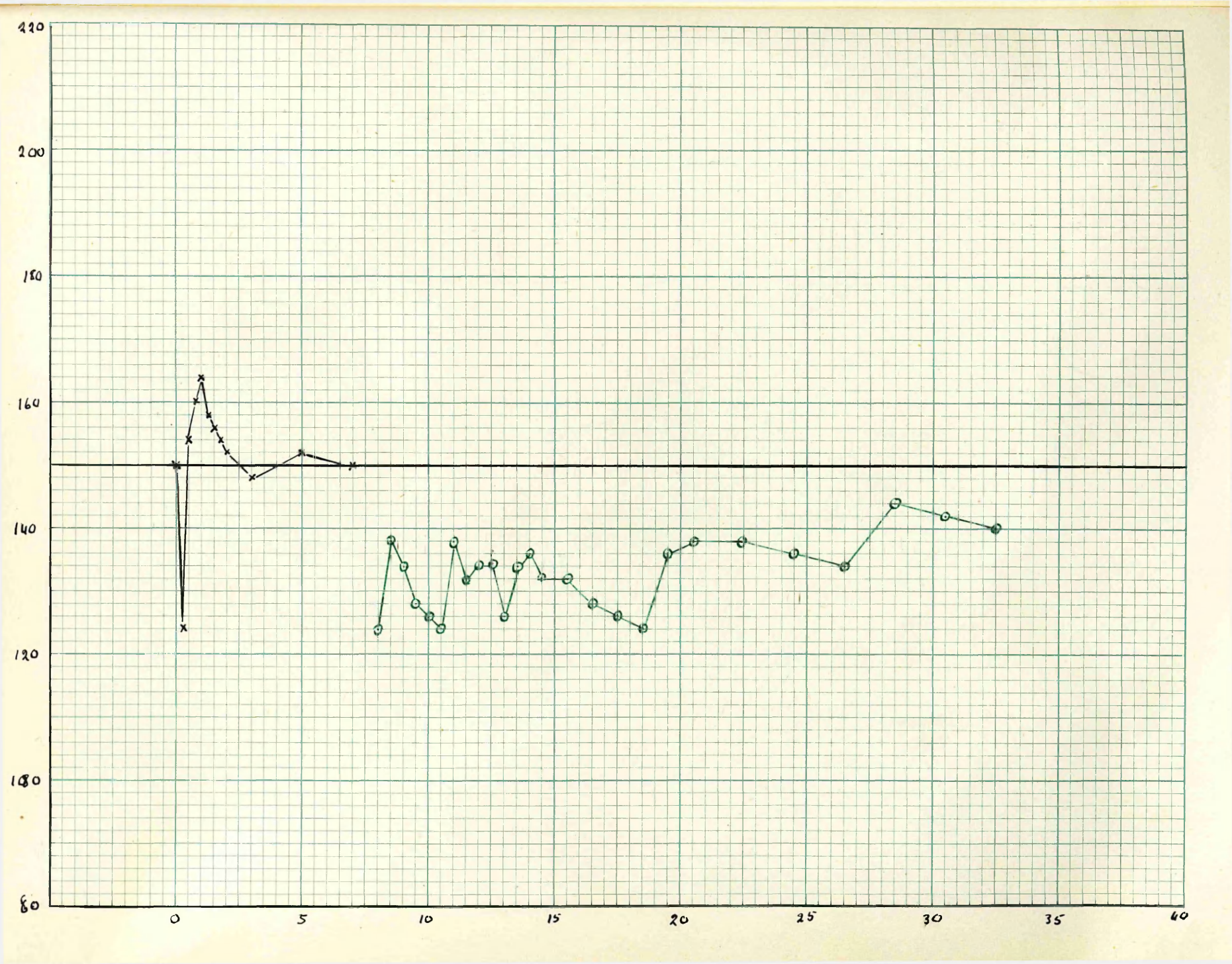
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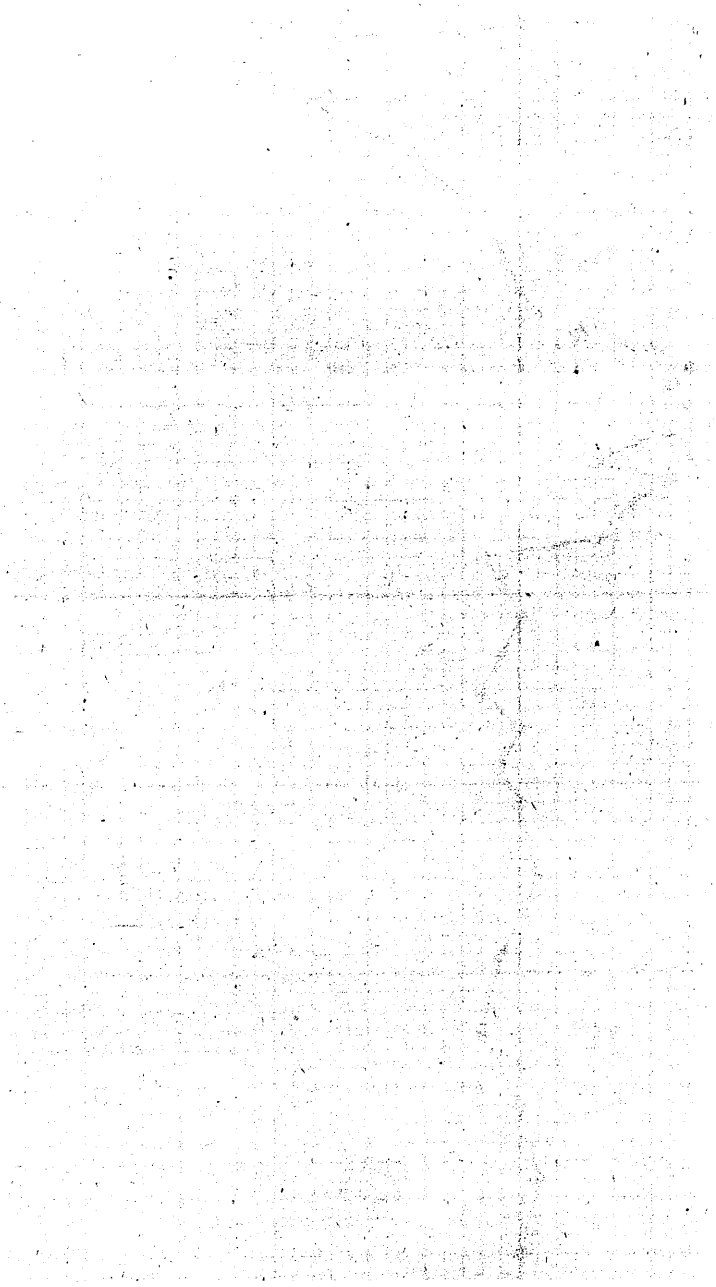
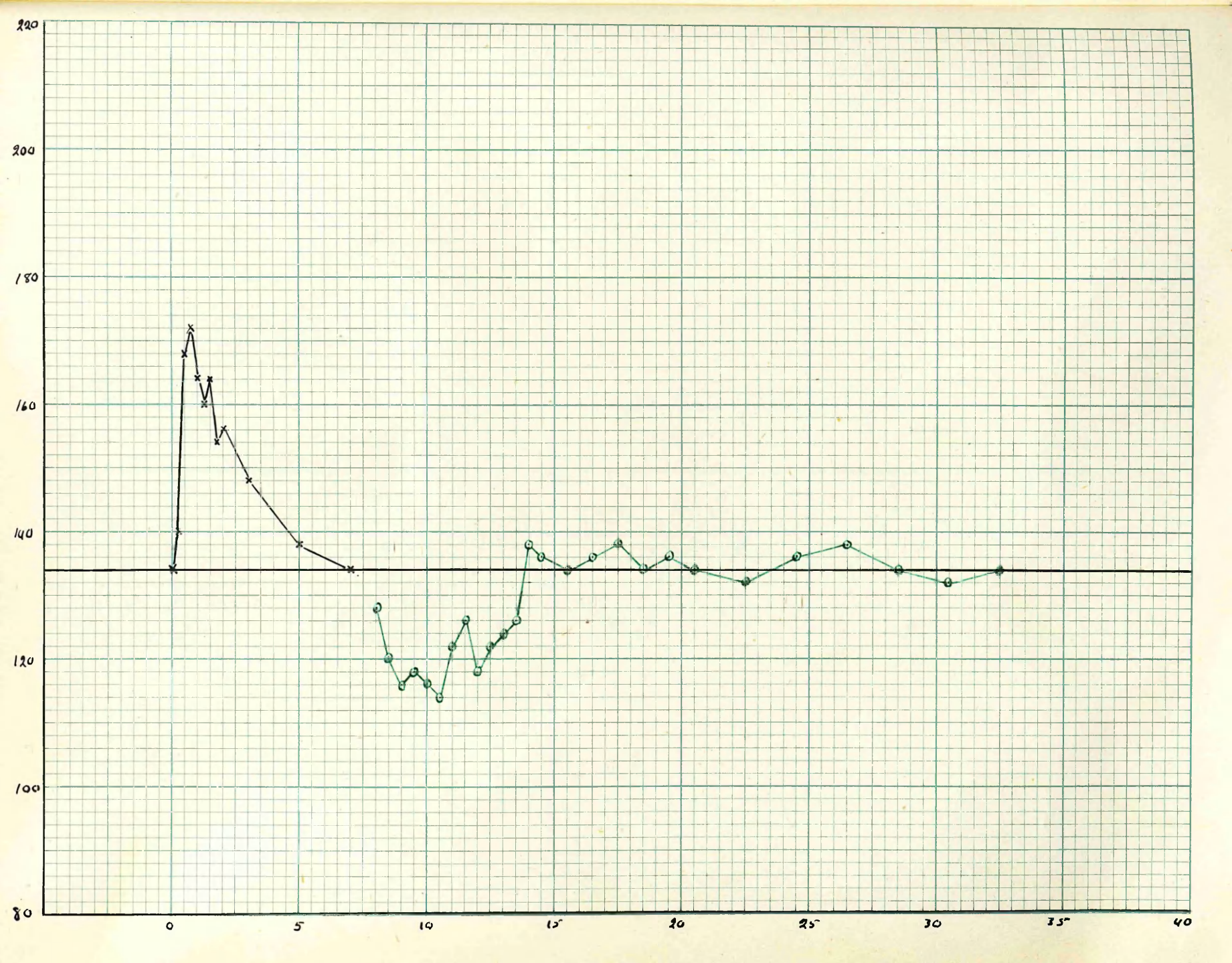
0200 WESTERMAN AK. DAY 0

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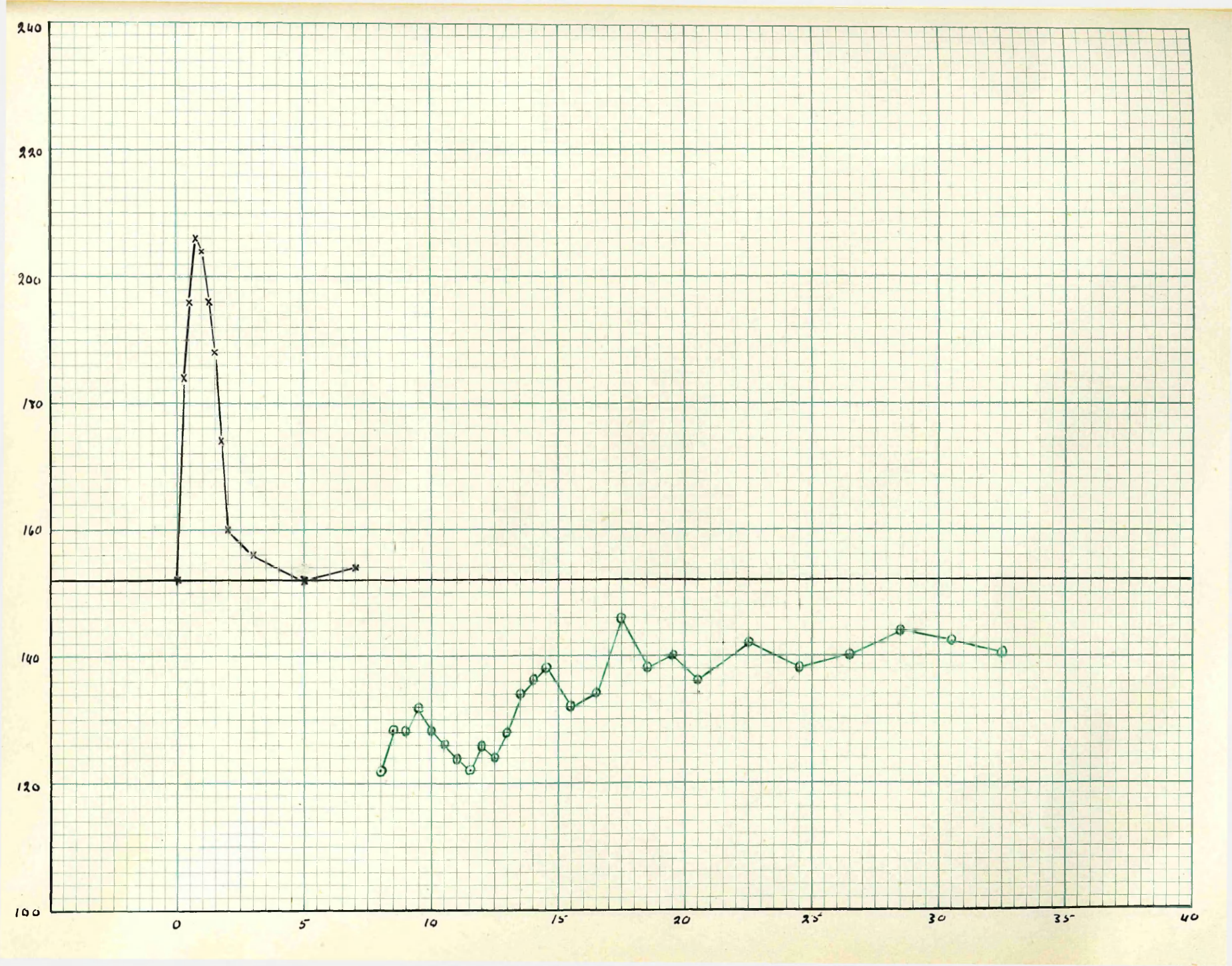
0210 TOMLINSON S DAY 0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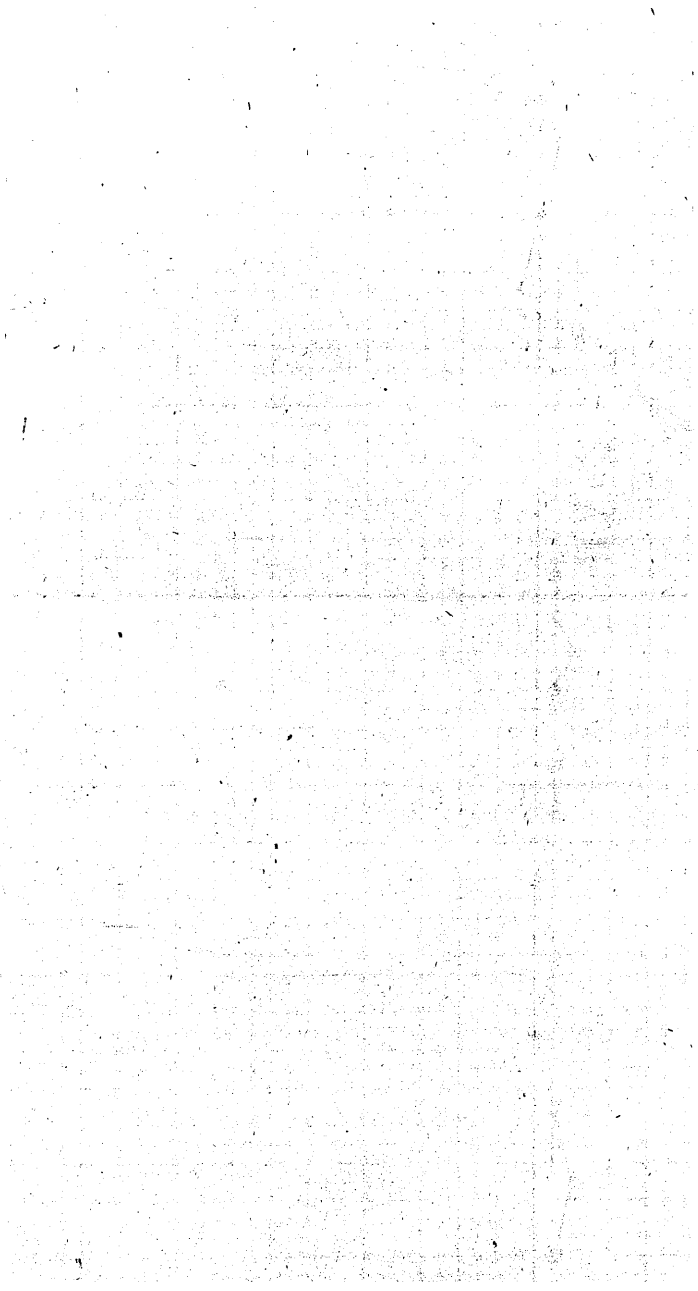
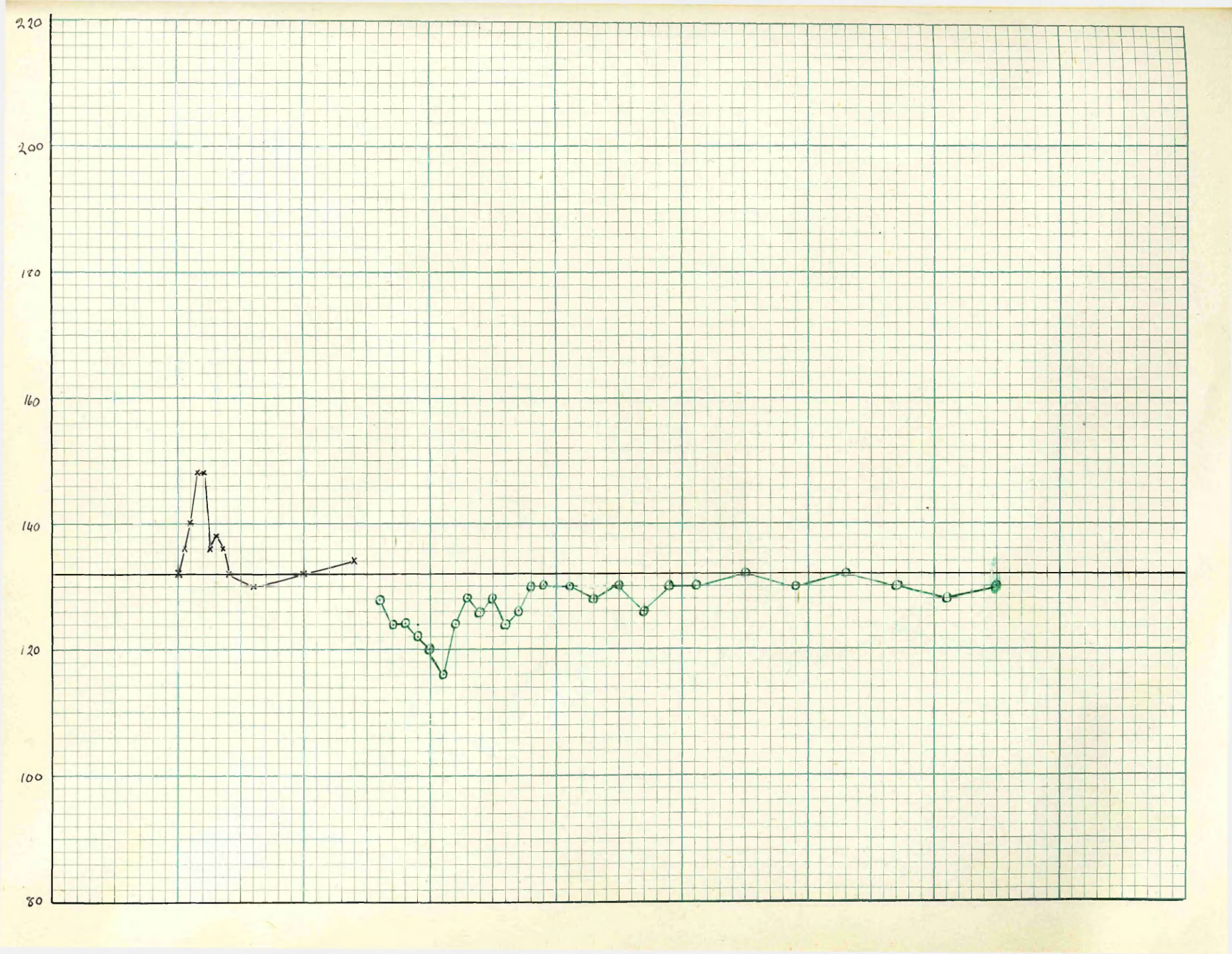
0220 STONES A. DAY 0

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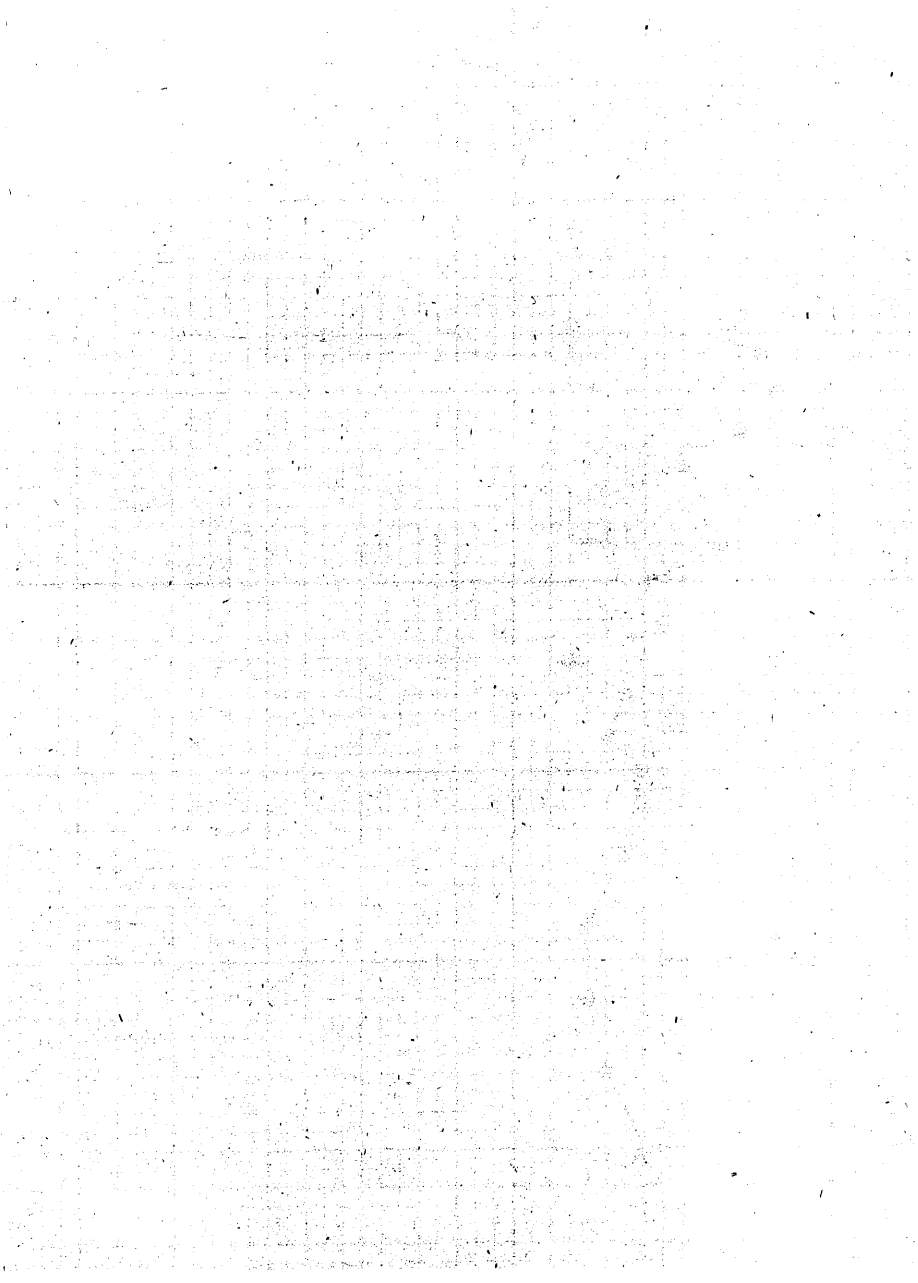

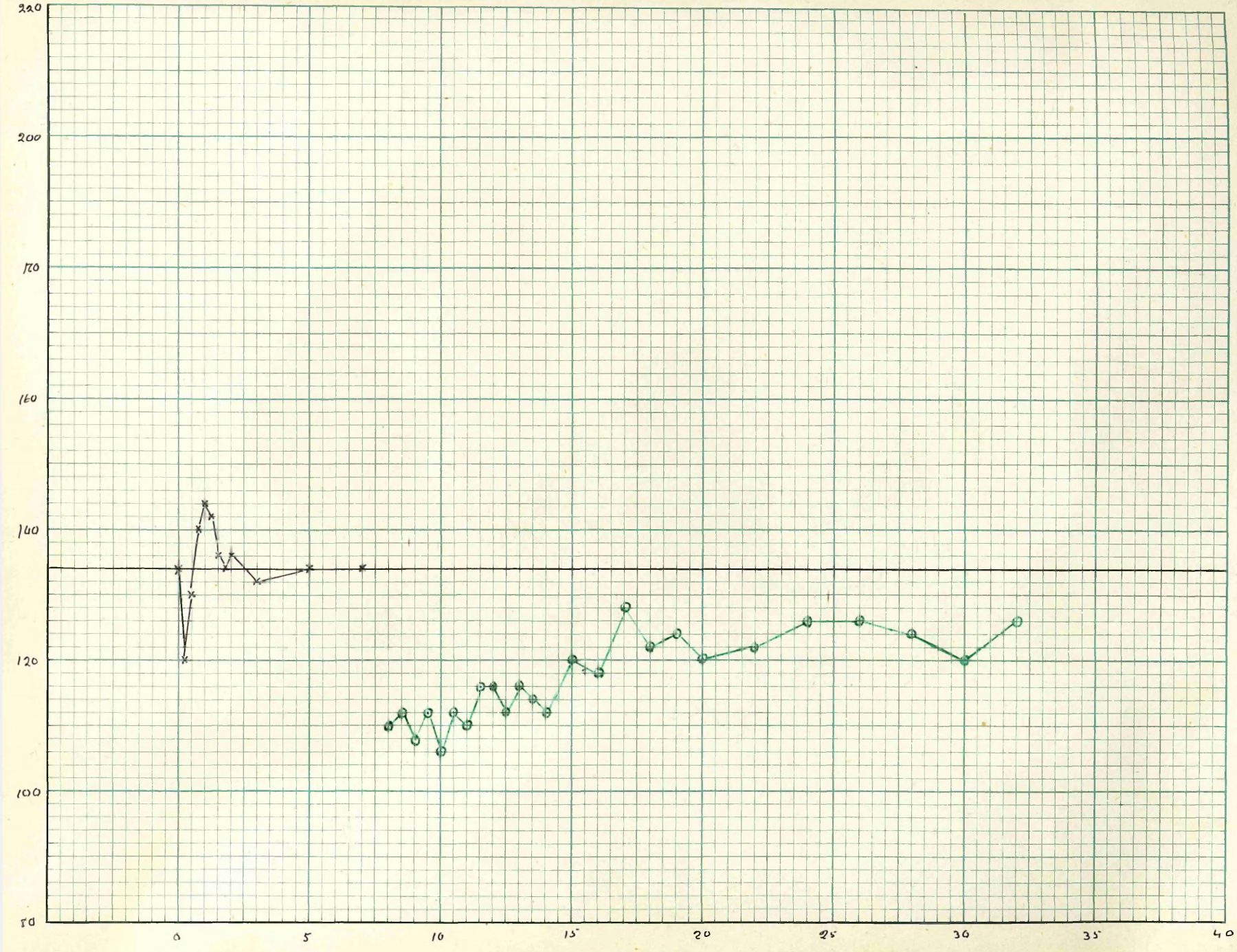
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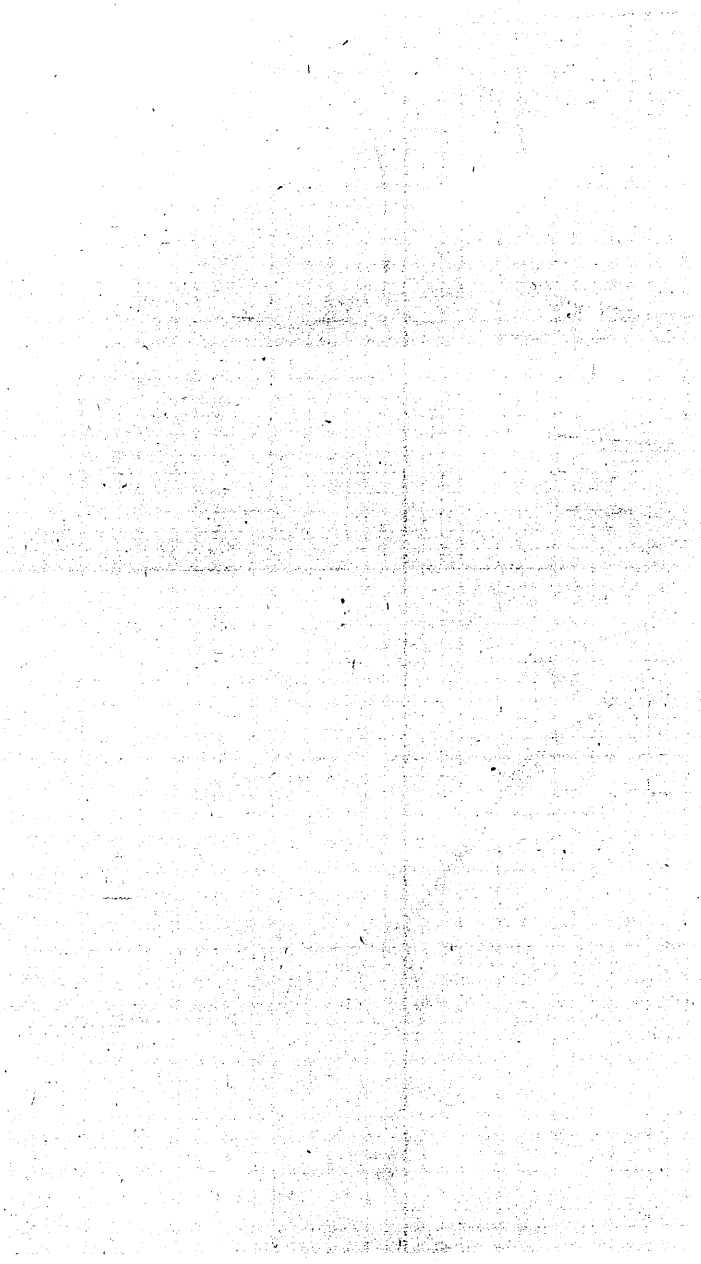
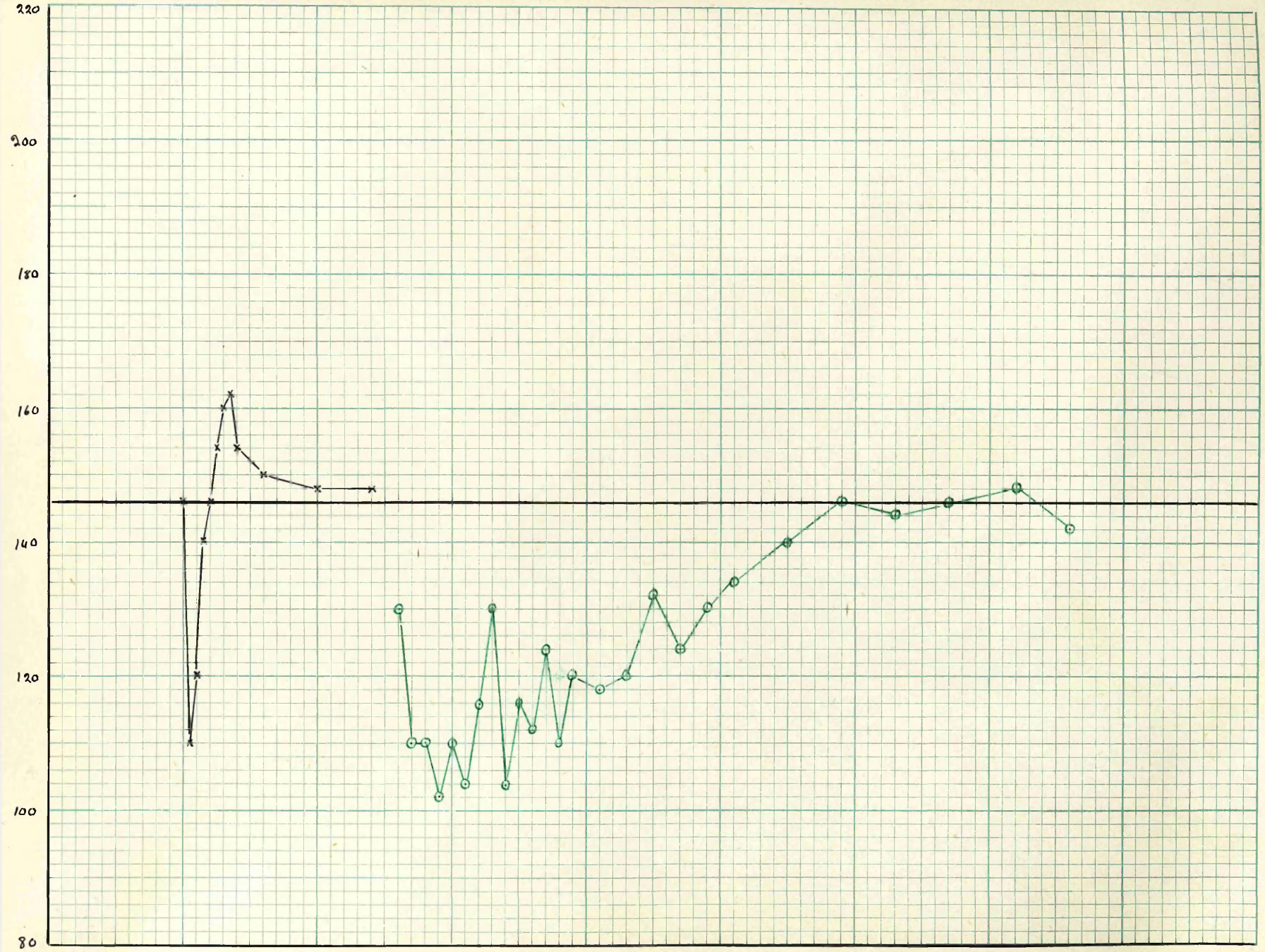
0240 LAVERACK L DAY 0

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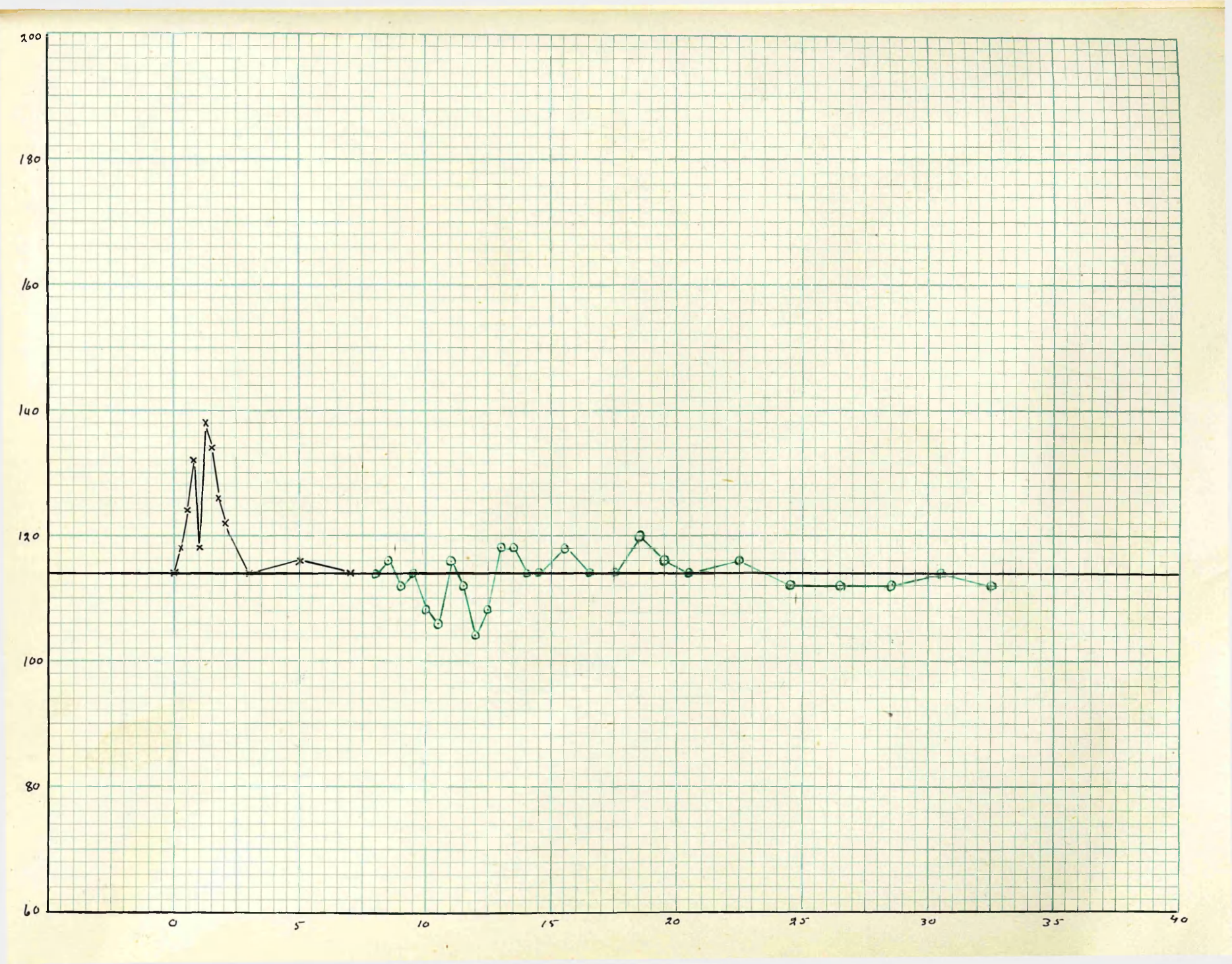
0250 THORNTON W DAY 0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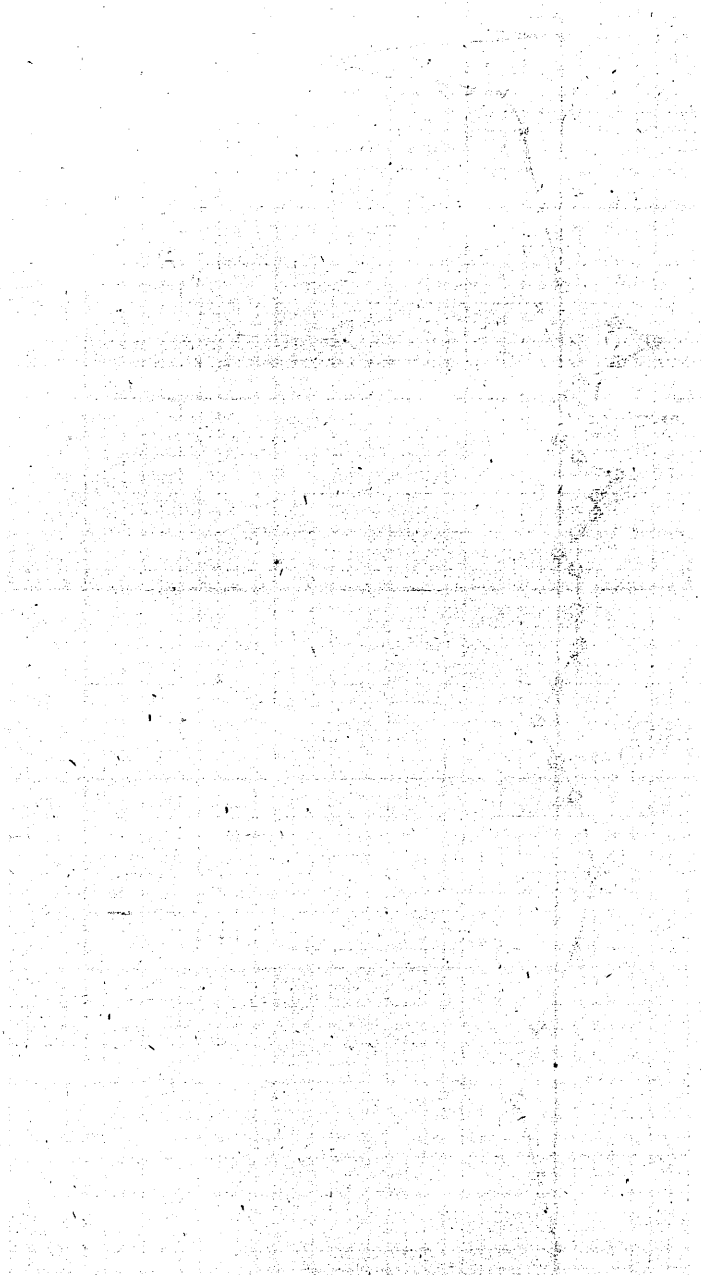
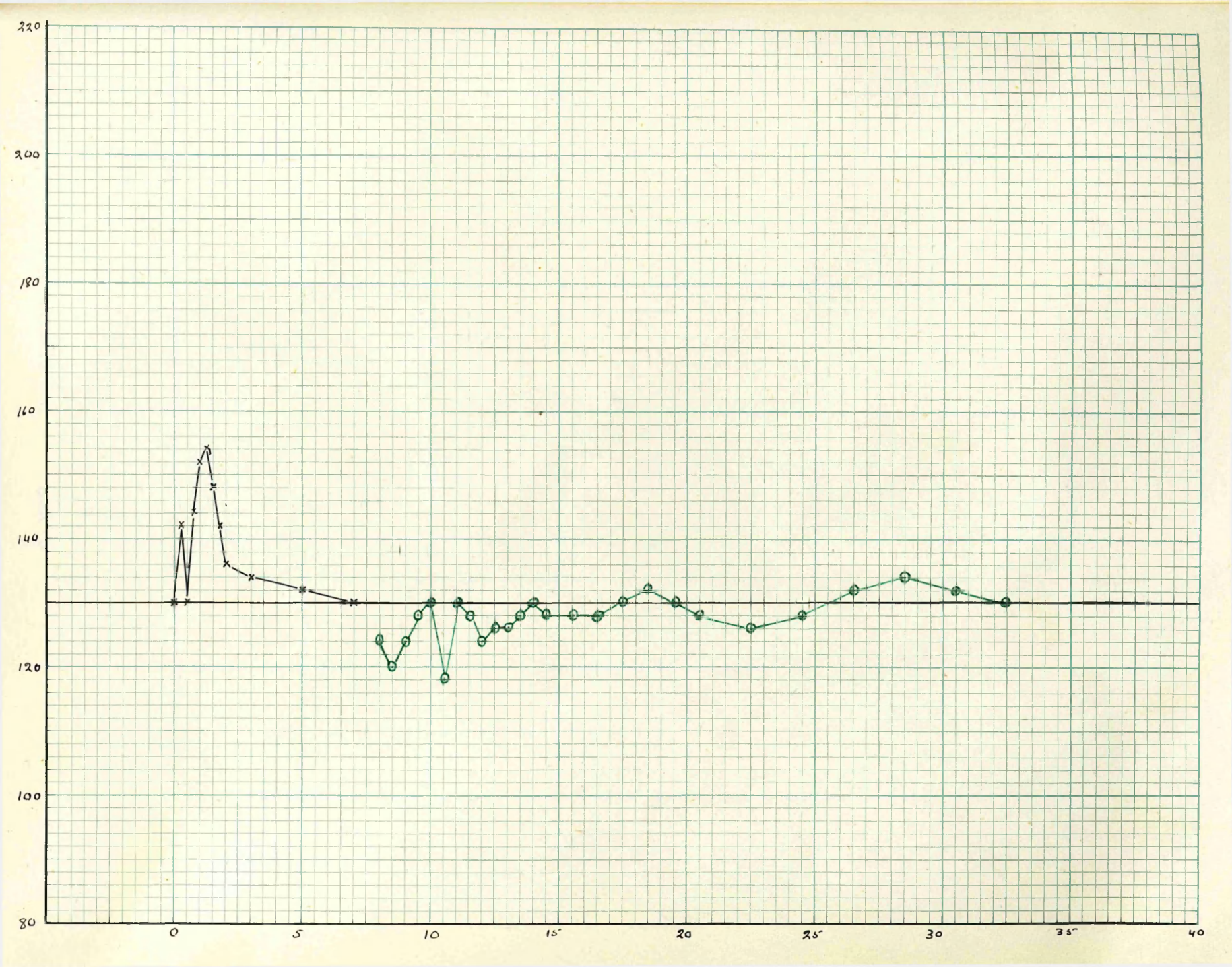
0260 MOOREHOUSE D PAY 0

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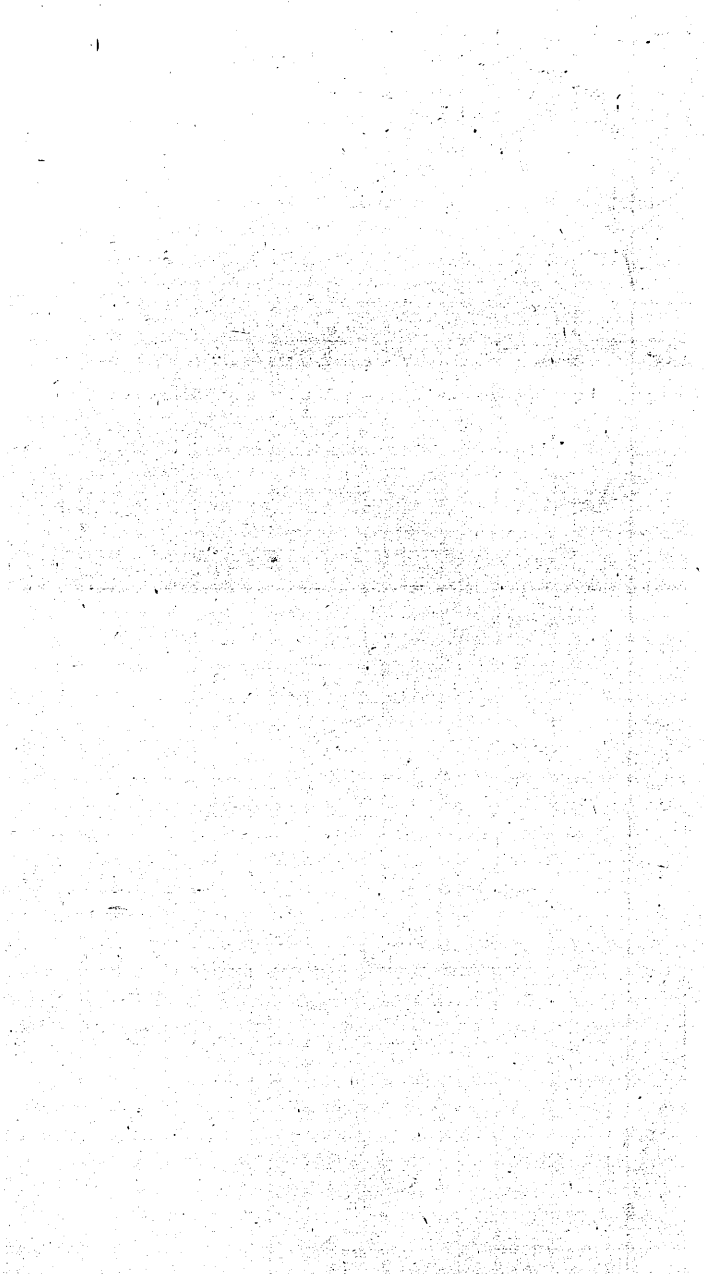


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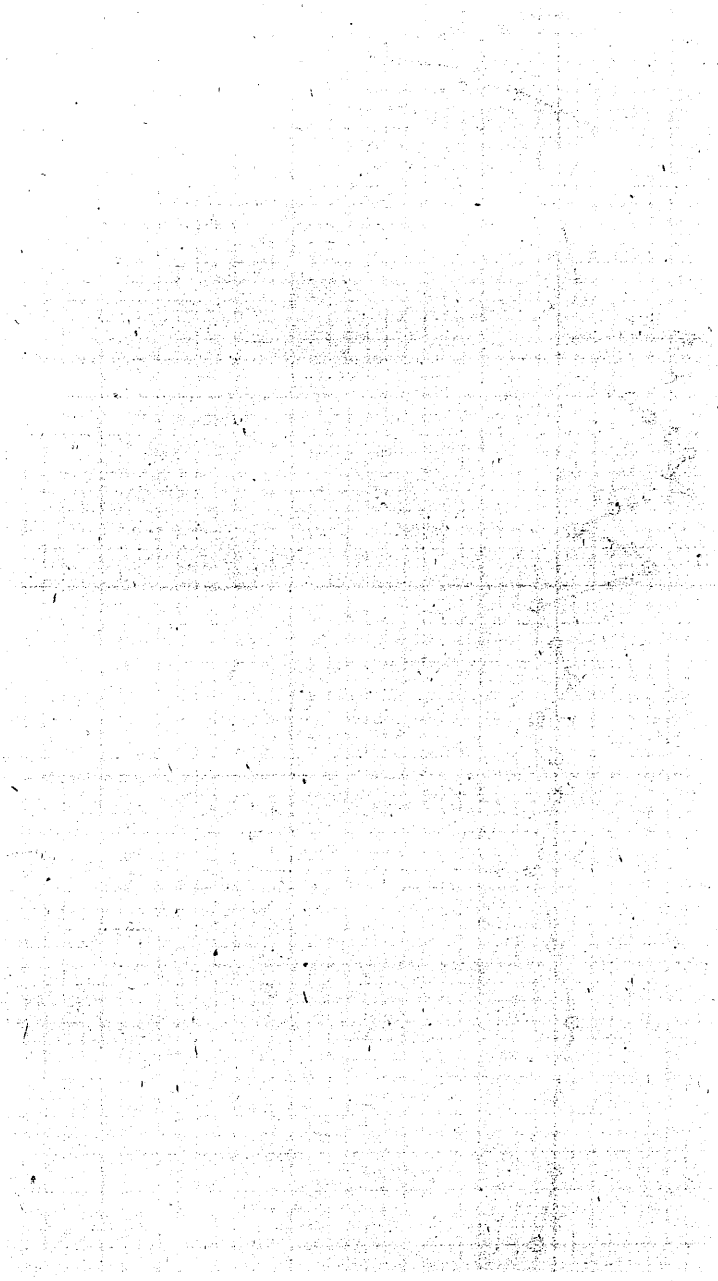
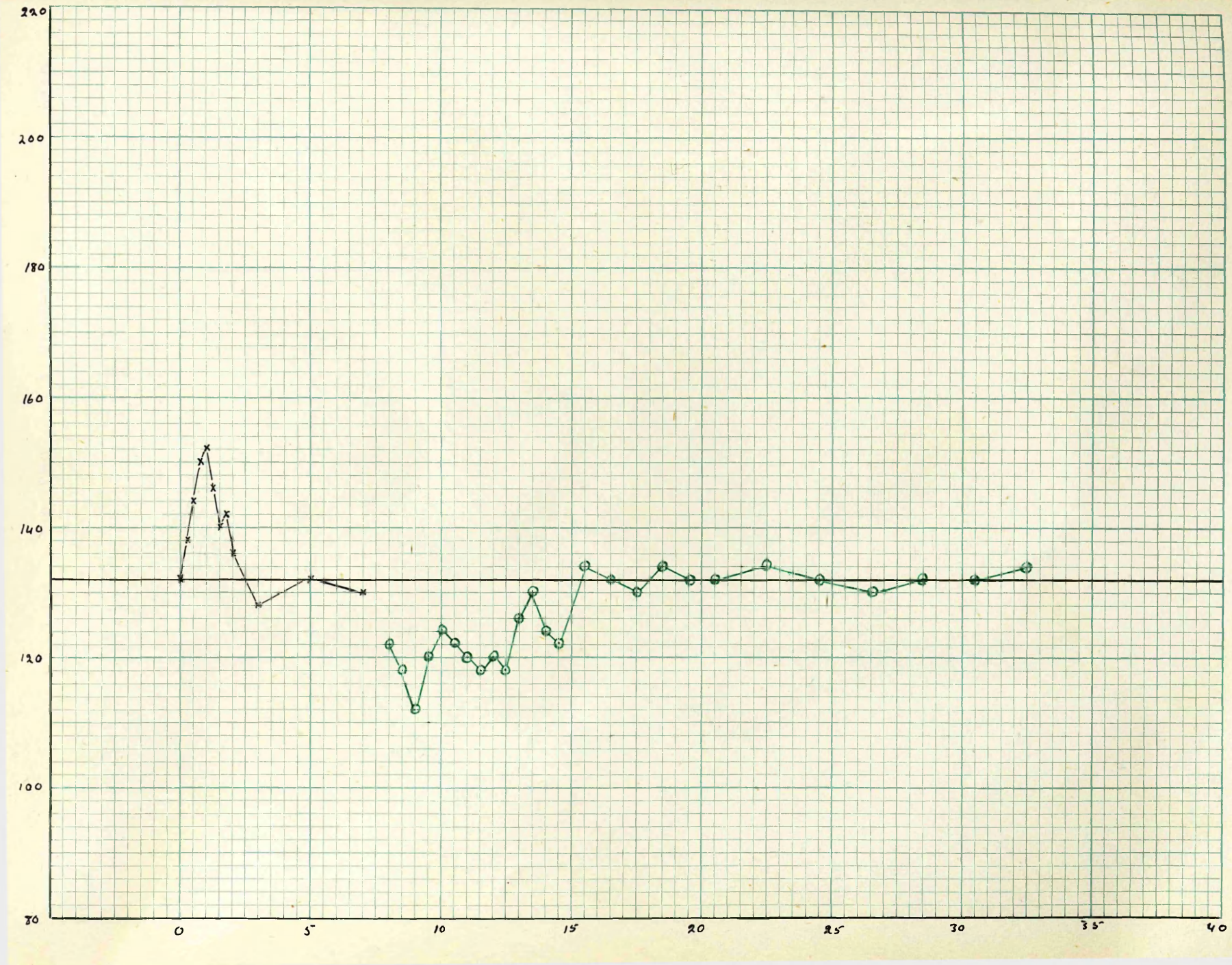
0280 STANLEY L DAY O.

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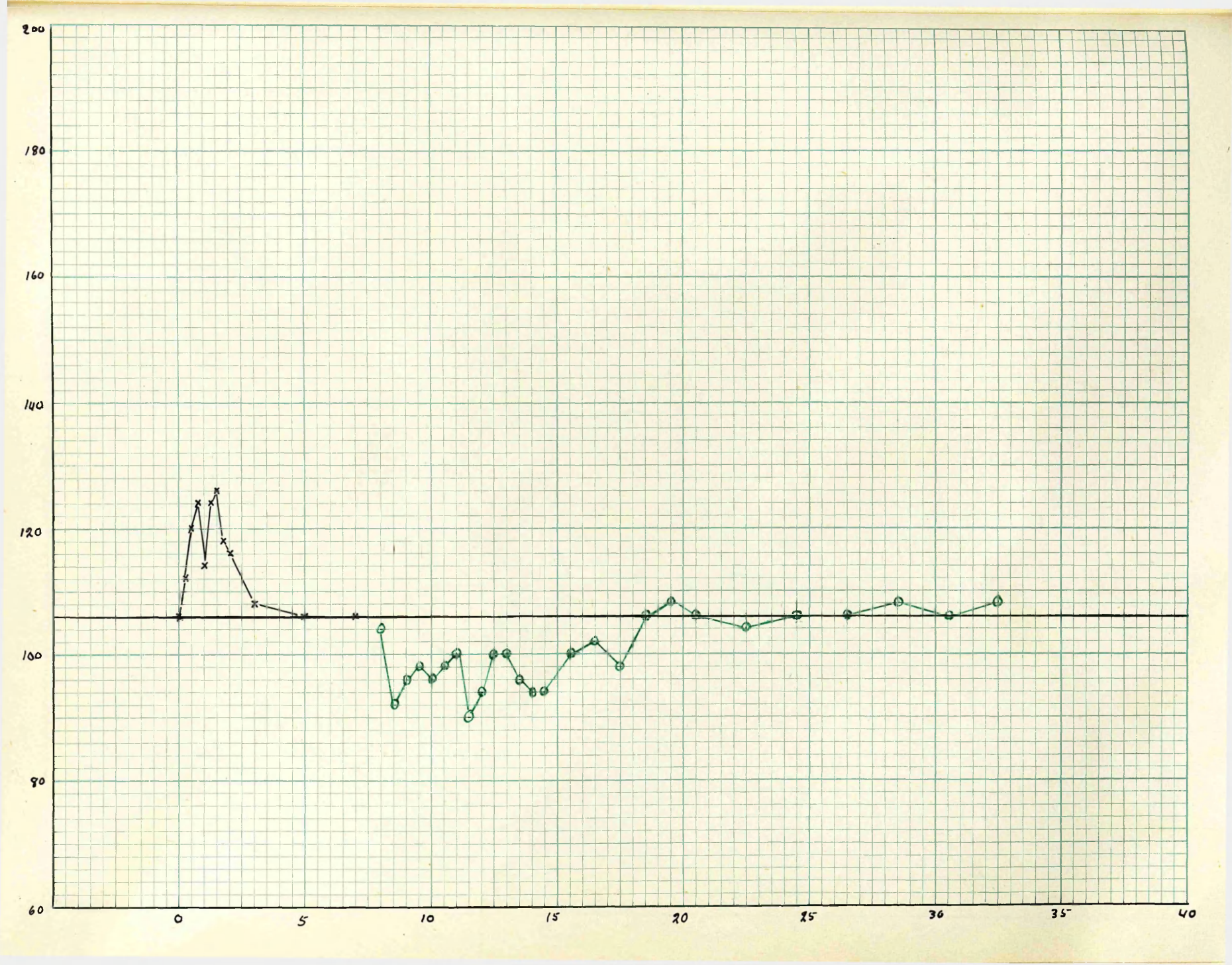
0290 ~~STANLEY L~~ GUY J DAY O.

0290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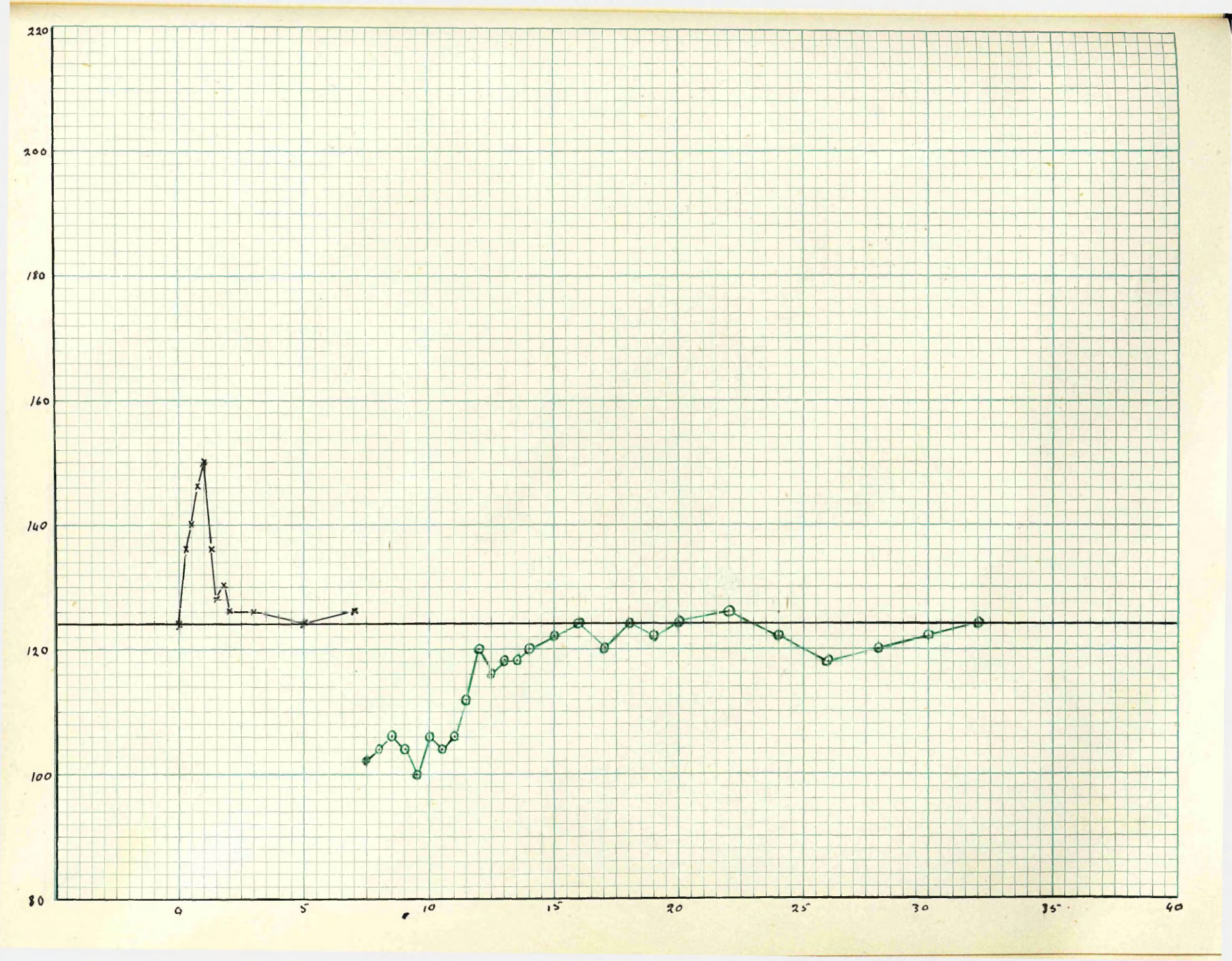
0300 GLOVER G DAY 0


220
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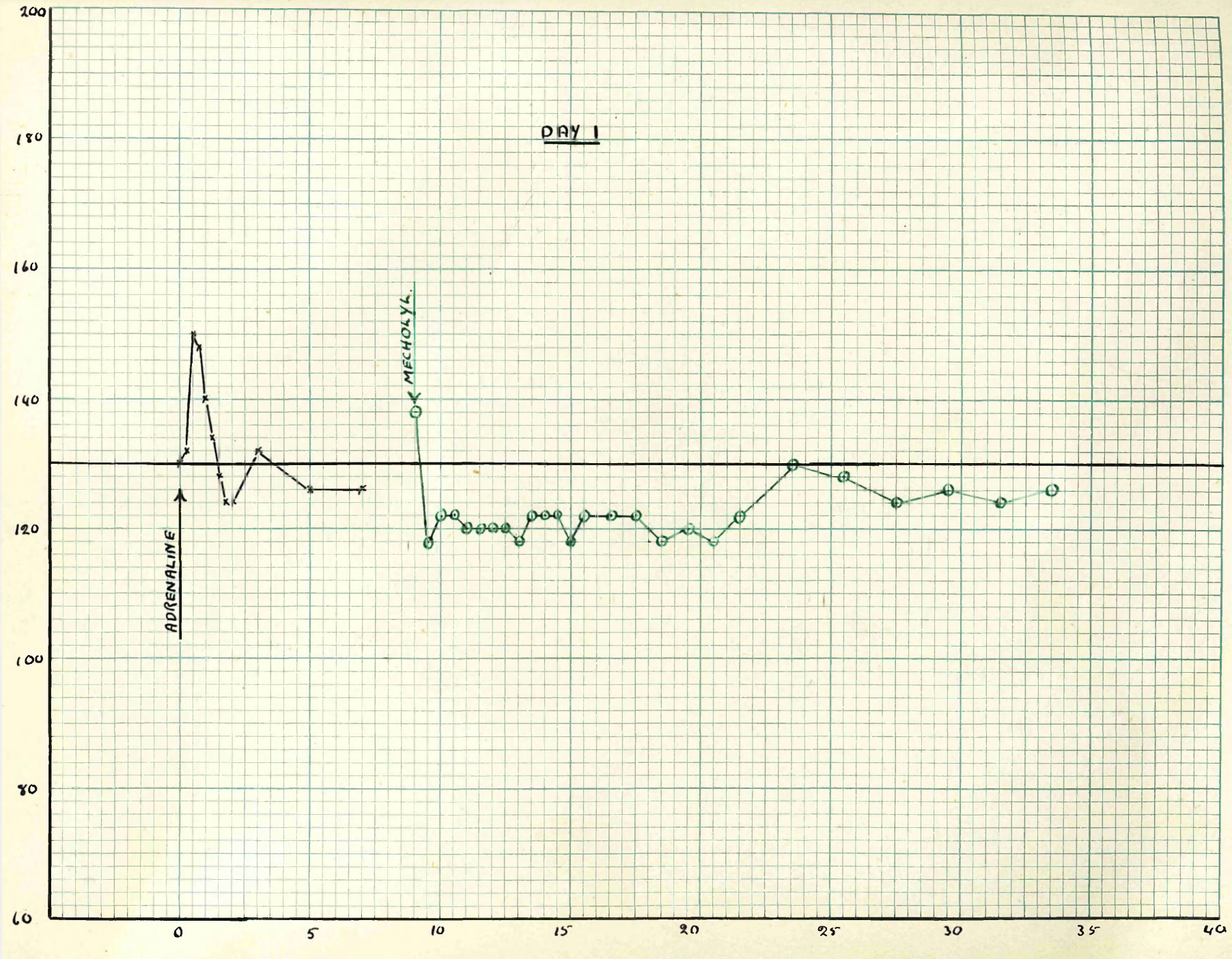
DEPRESSIVE PATIENTS TESTED AFTER ONE DAY INTERVAL.


DAY 1
ADRENALINE
MECHOLYL.
200
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140
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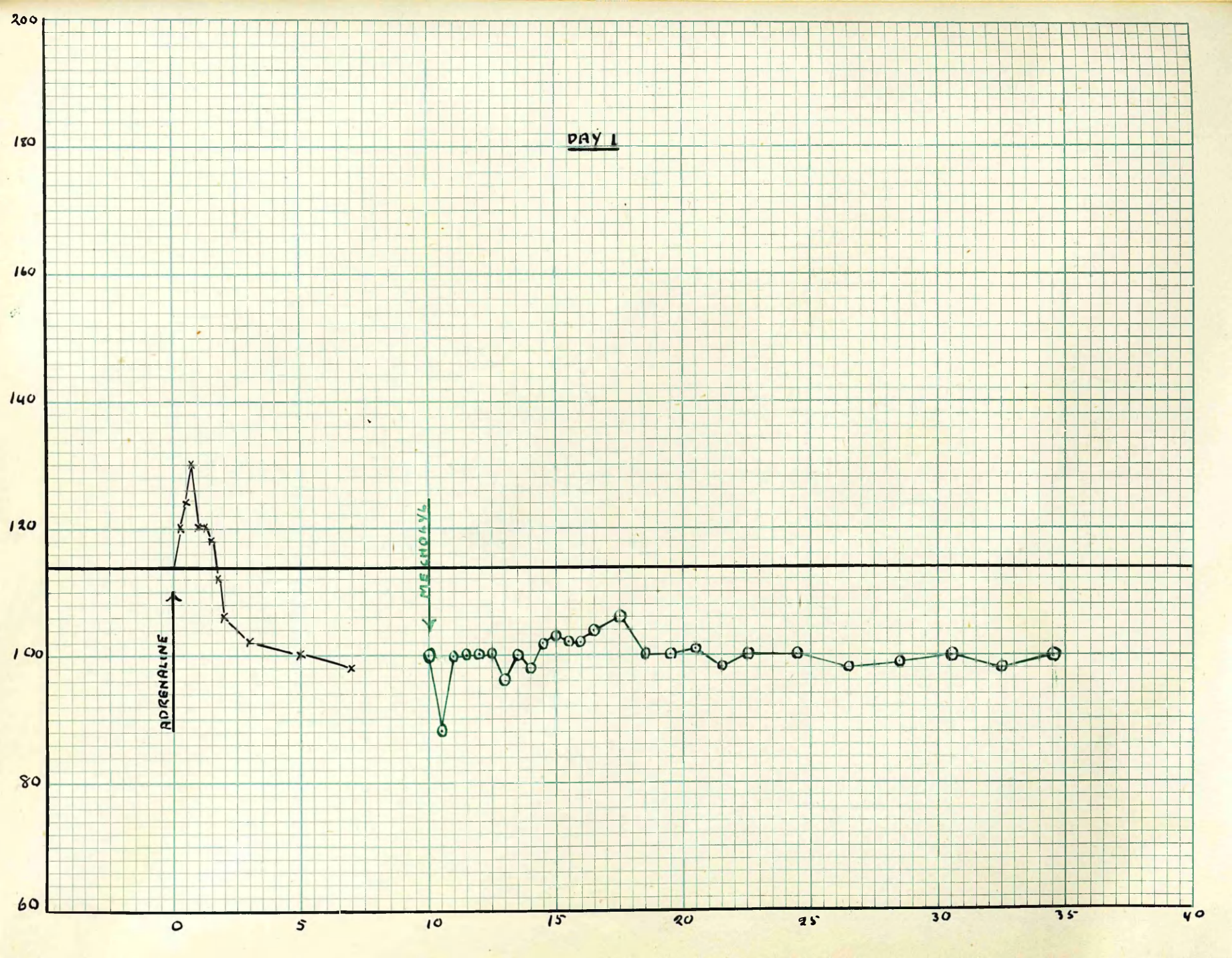
~~0012~~
0041

AXUP W DAY 1

AXUP (2)


DAY 1
200
180
160
140
120
100
80
60
ADRENALINE
MECHOLYL
0
5
10
15
20
25
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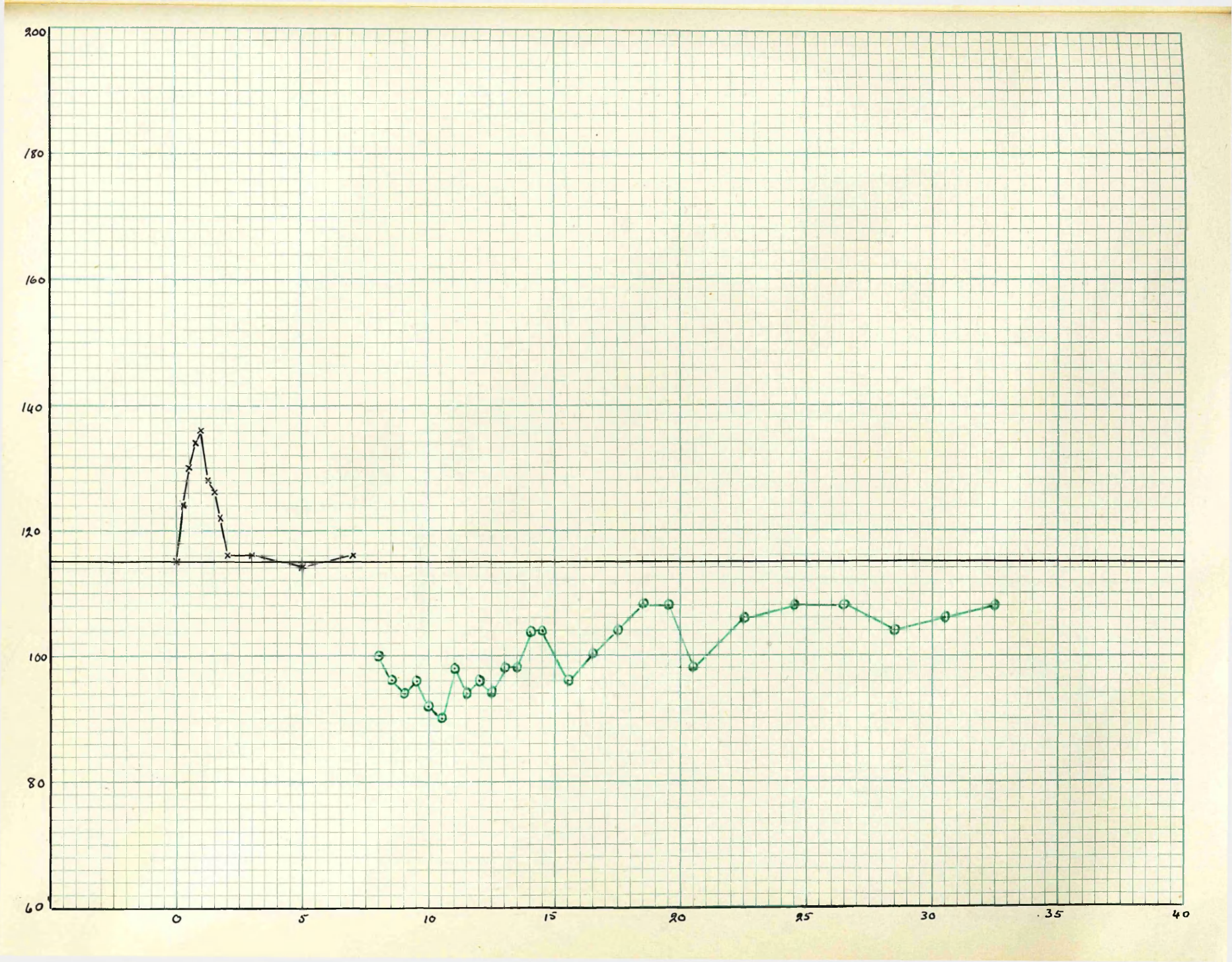
40

~~0031~~
0071

HEWIT J DAY 1


200
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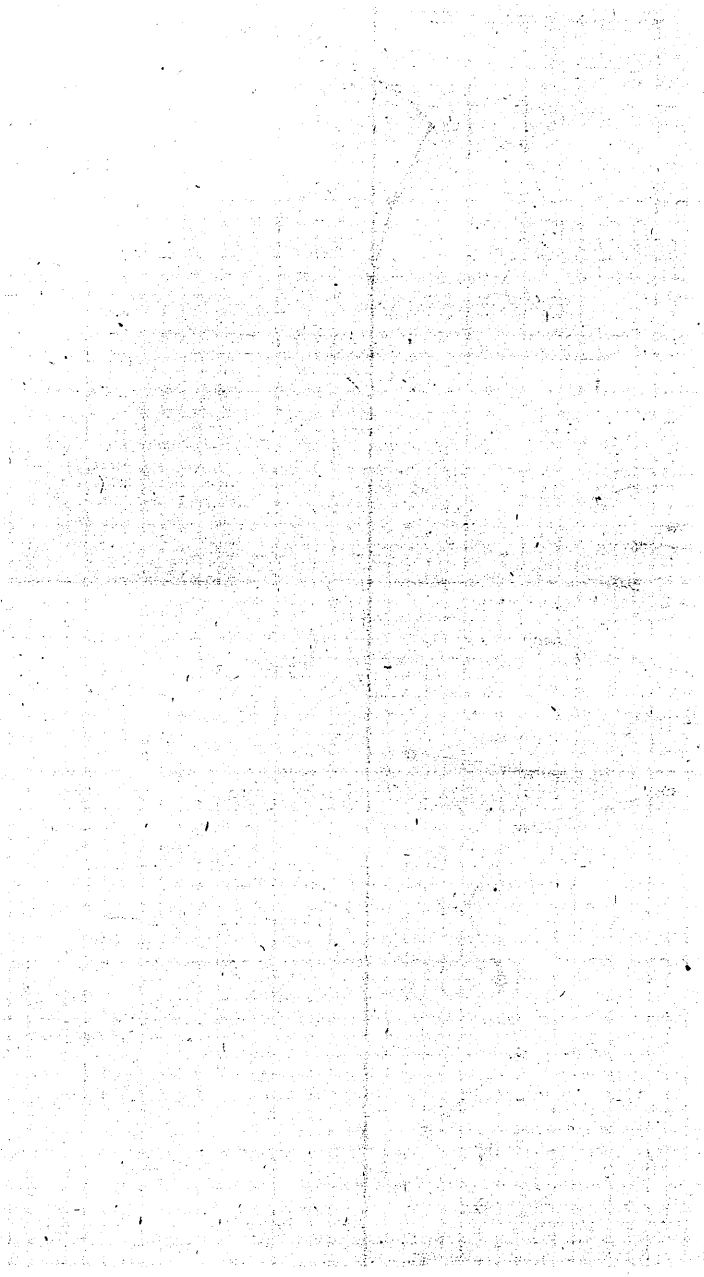
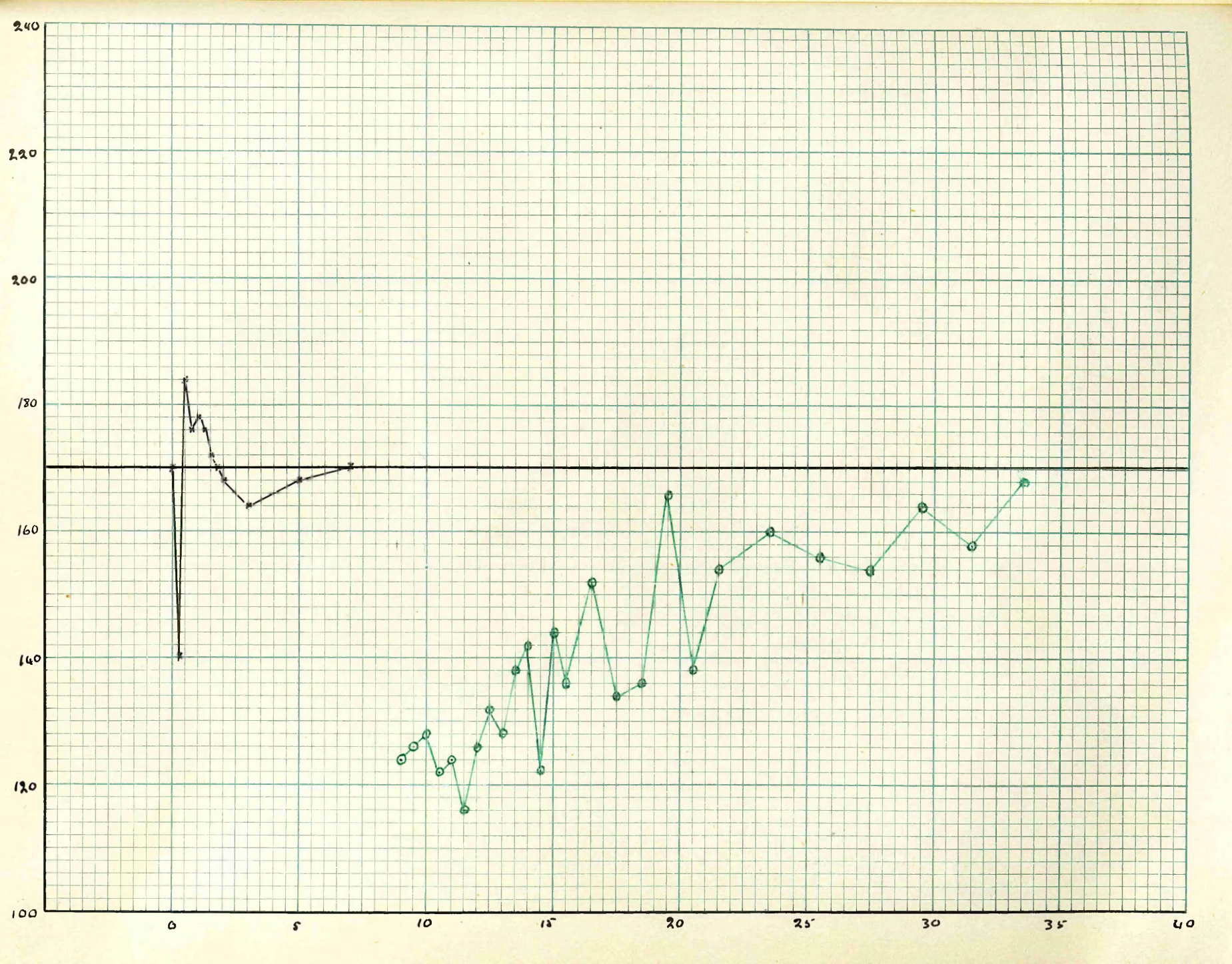
~~0041~~
0081

Gluck D DAY 1




240
220
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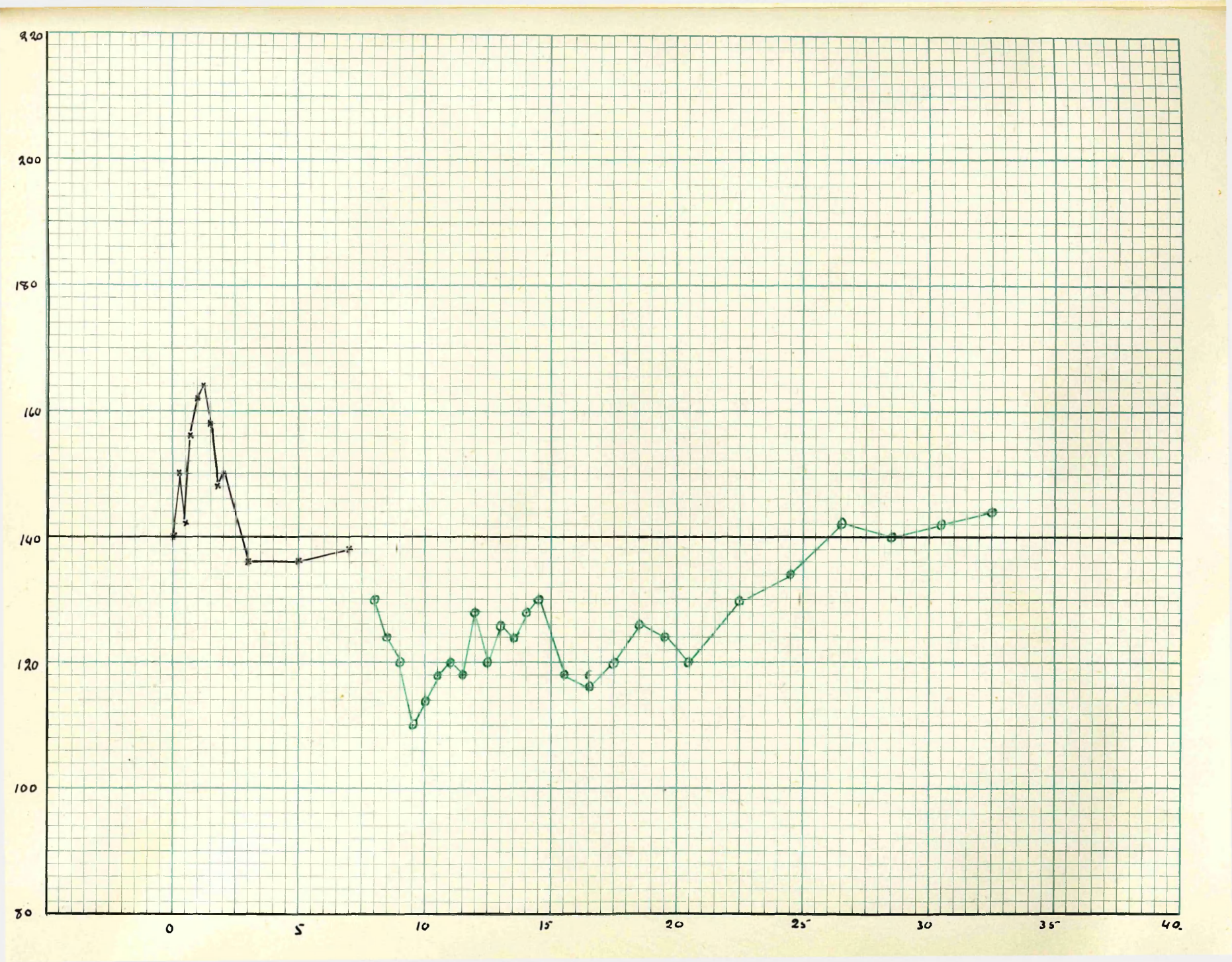
~~0051~~
0111

FRANCIS JH DAY 1


220
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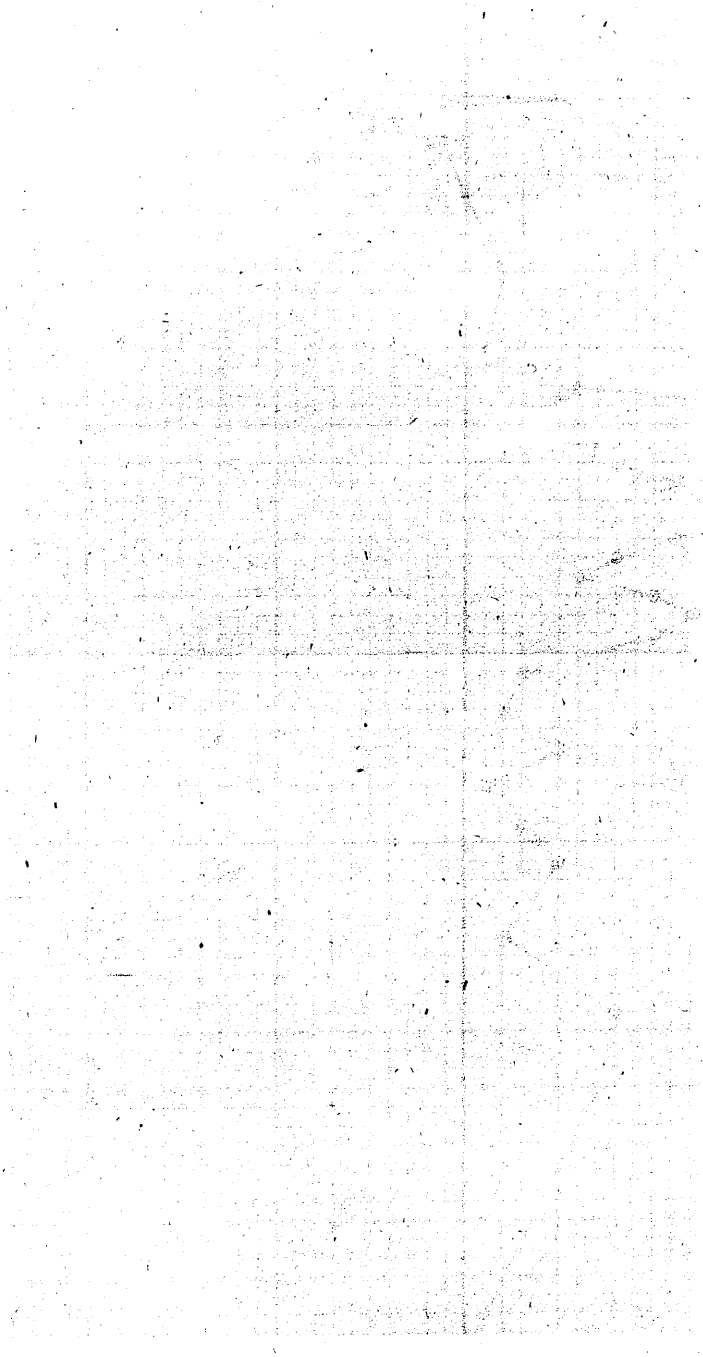
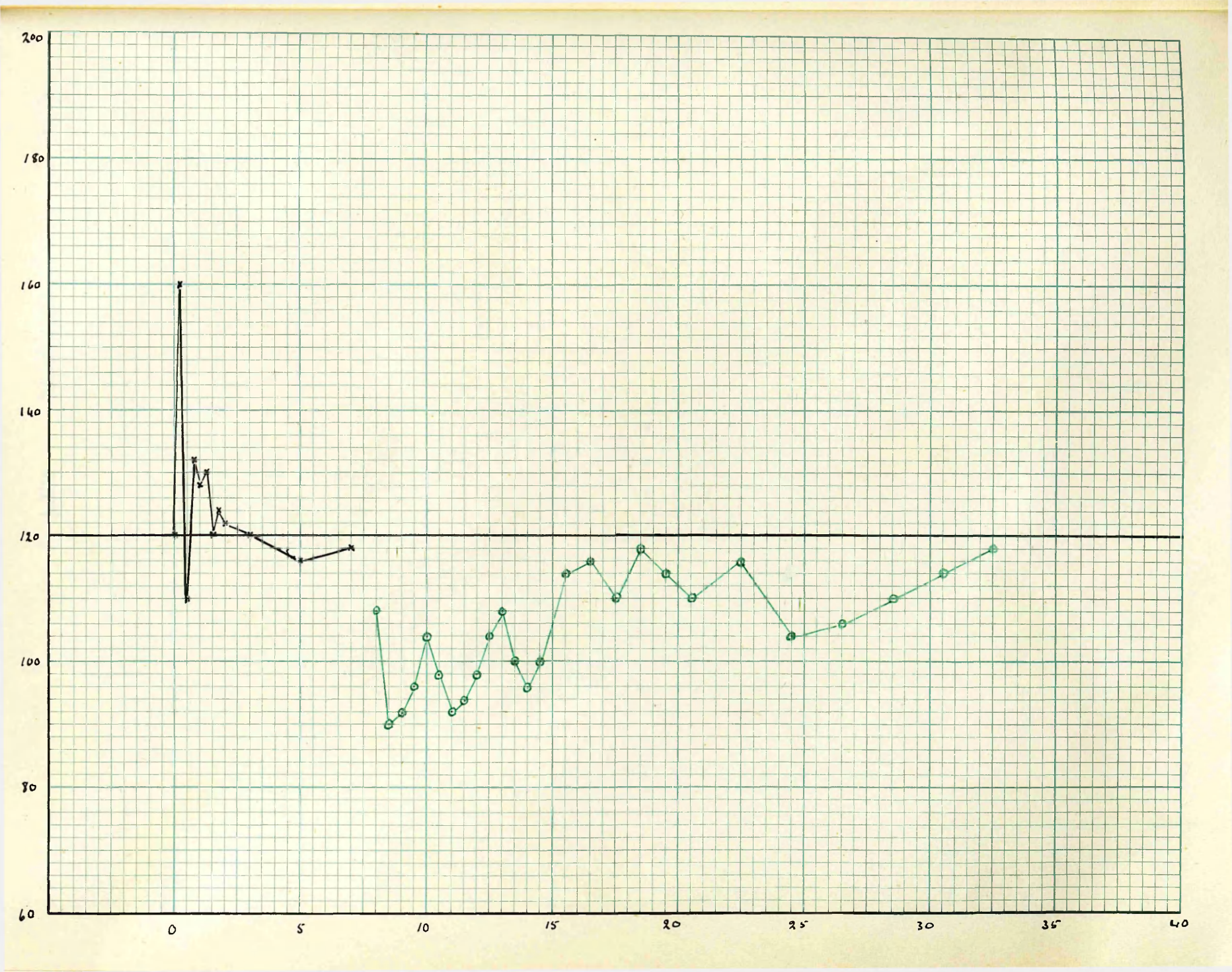
~~0061~~
0121

CARLIN RP DAY 1




200
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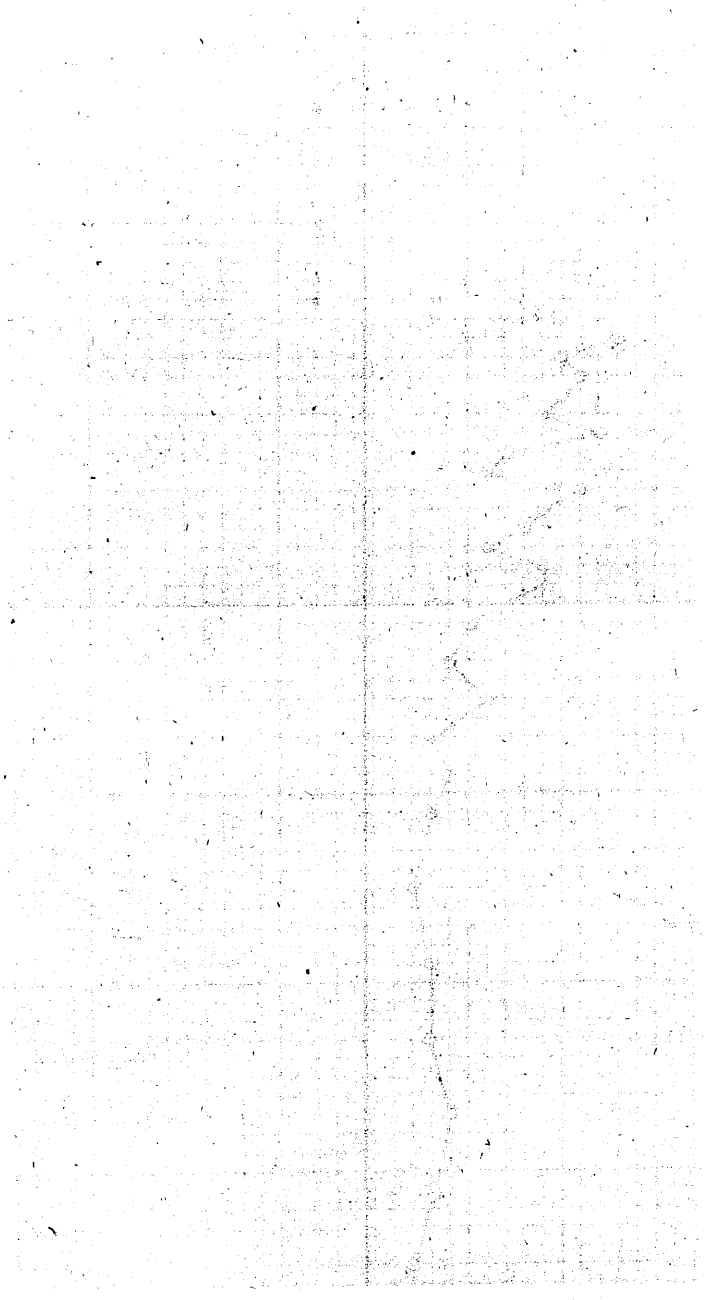
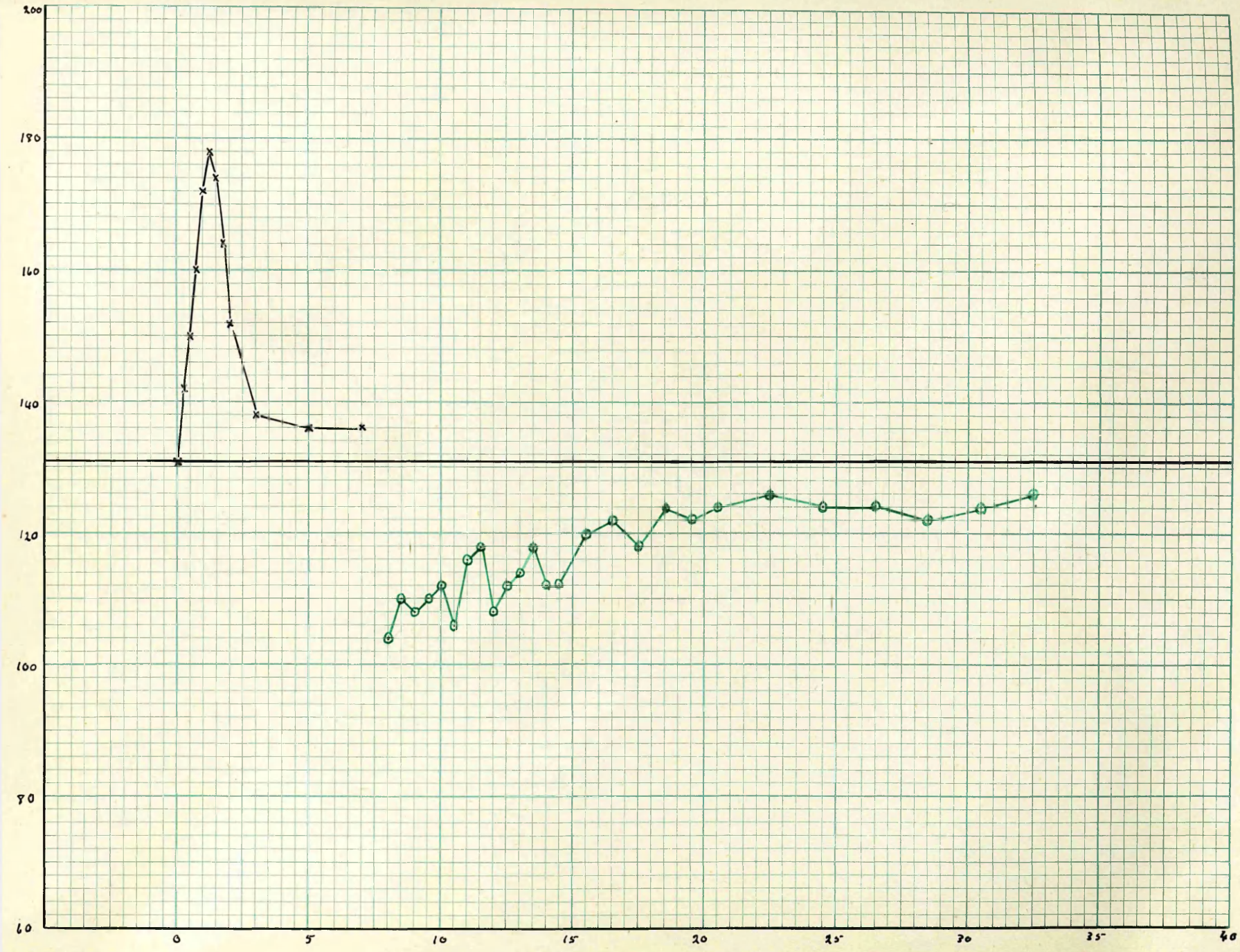
~~0041~~
0141

ROTHWELL DAY 1

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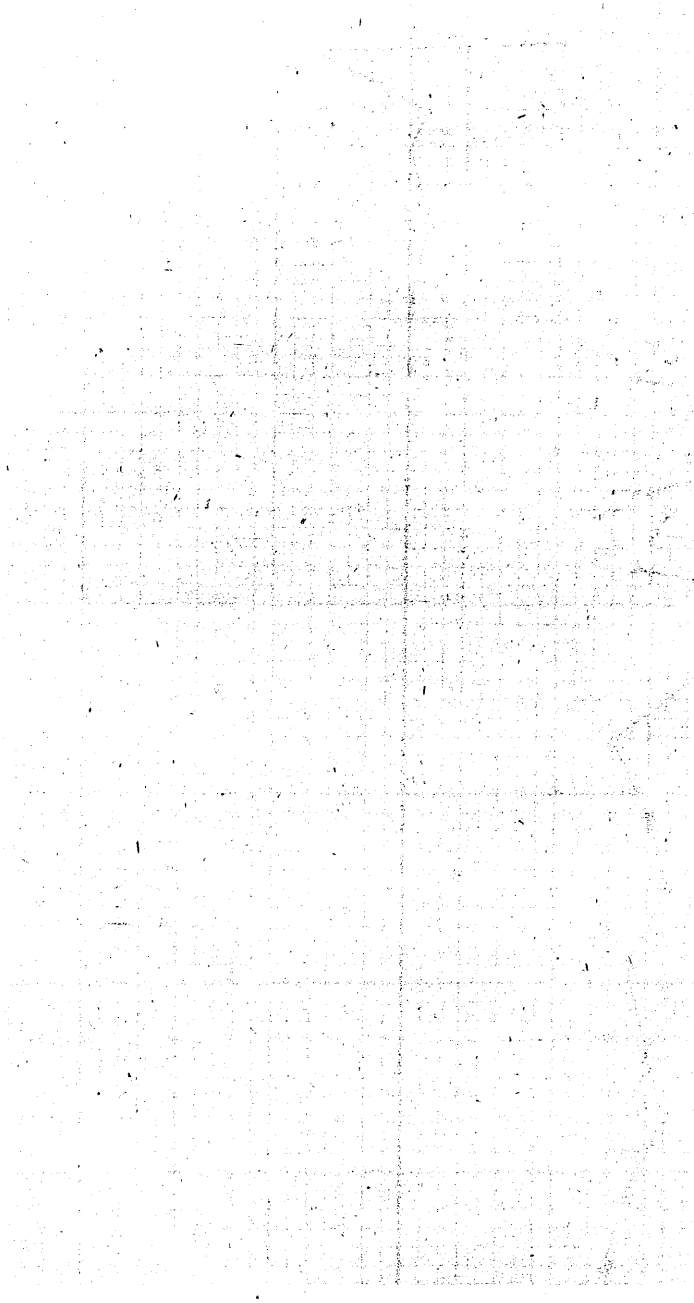
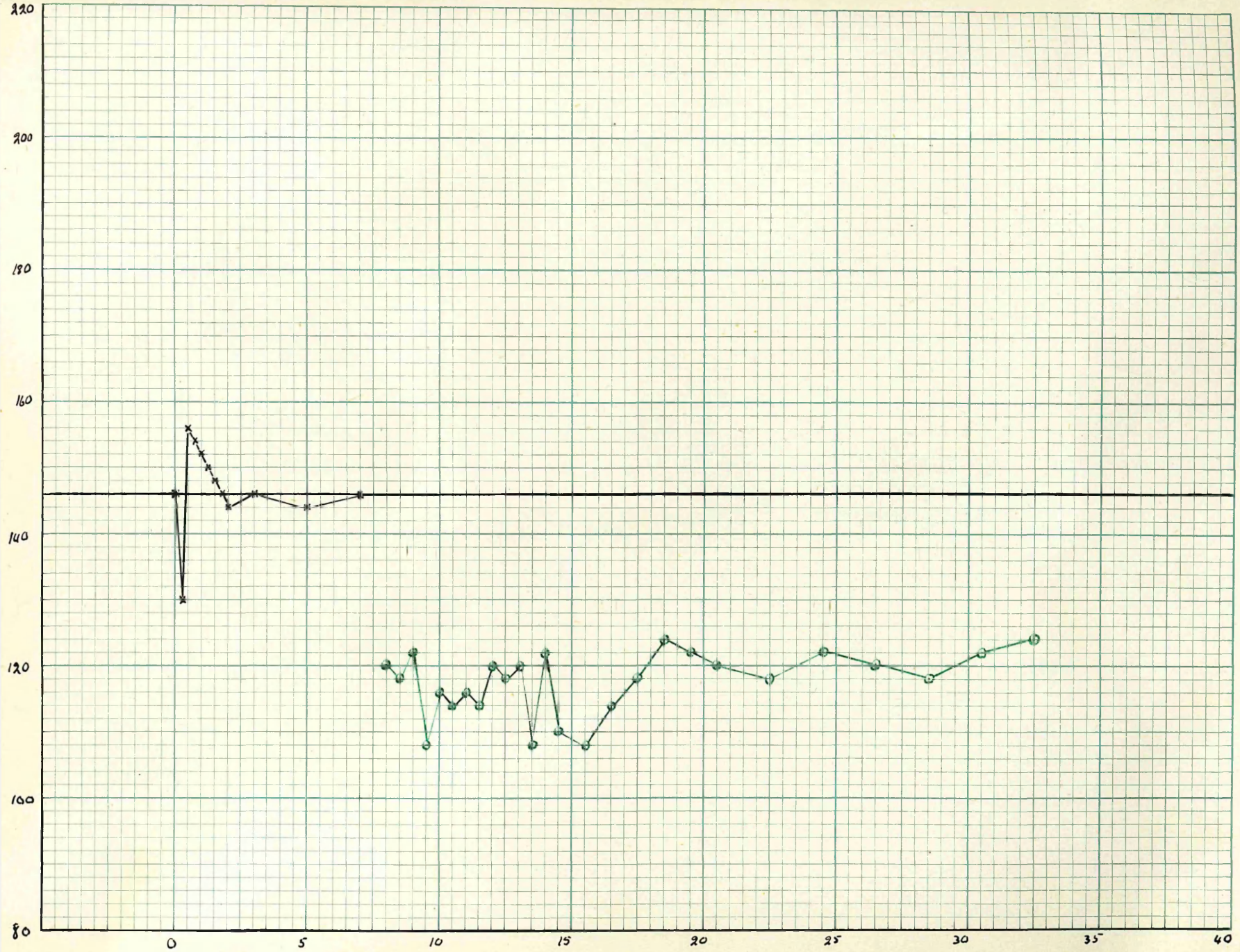
HEATON S DAY 1

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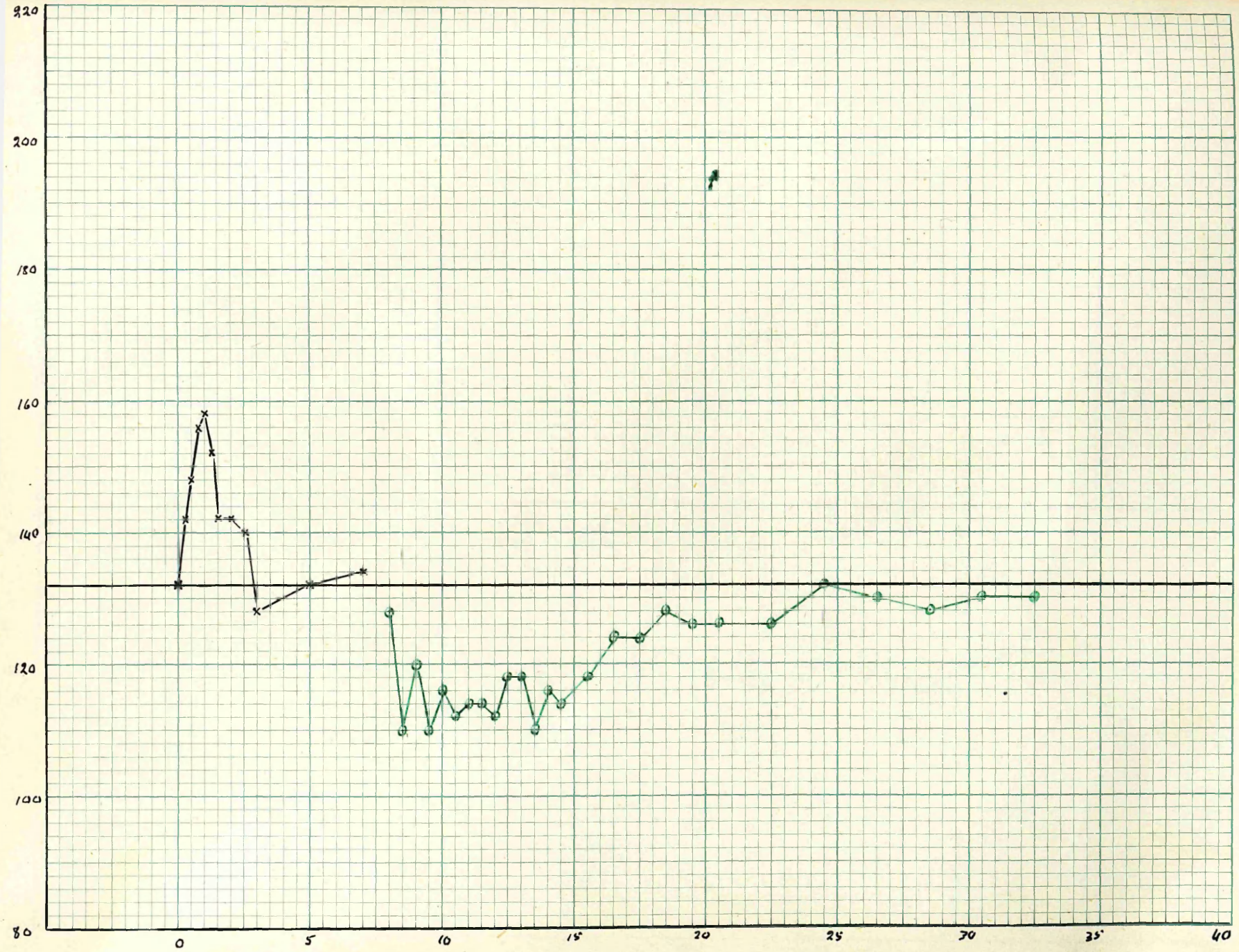
~~0091~~
0201

WESTERMAN AIC DAY 1


220
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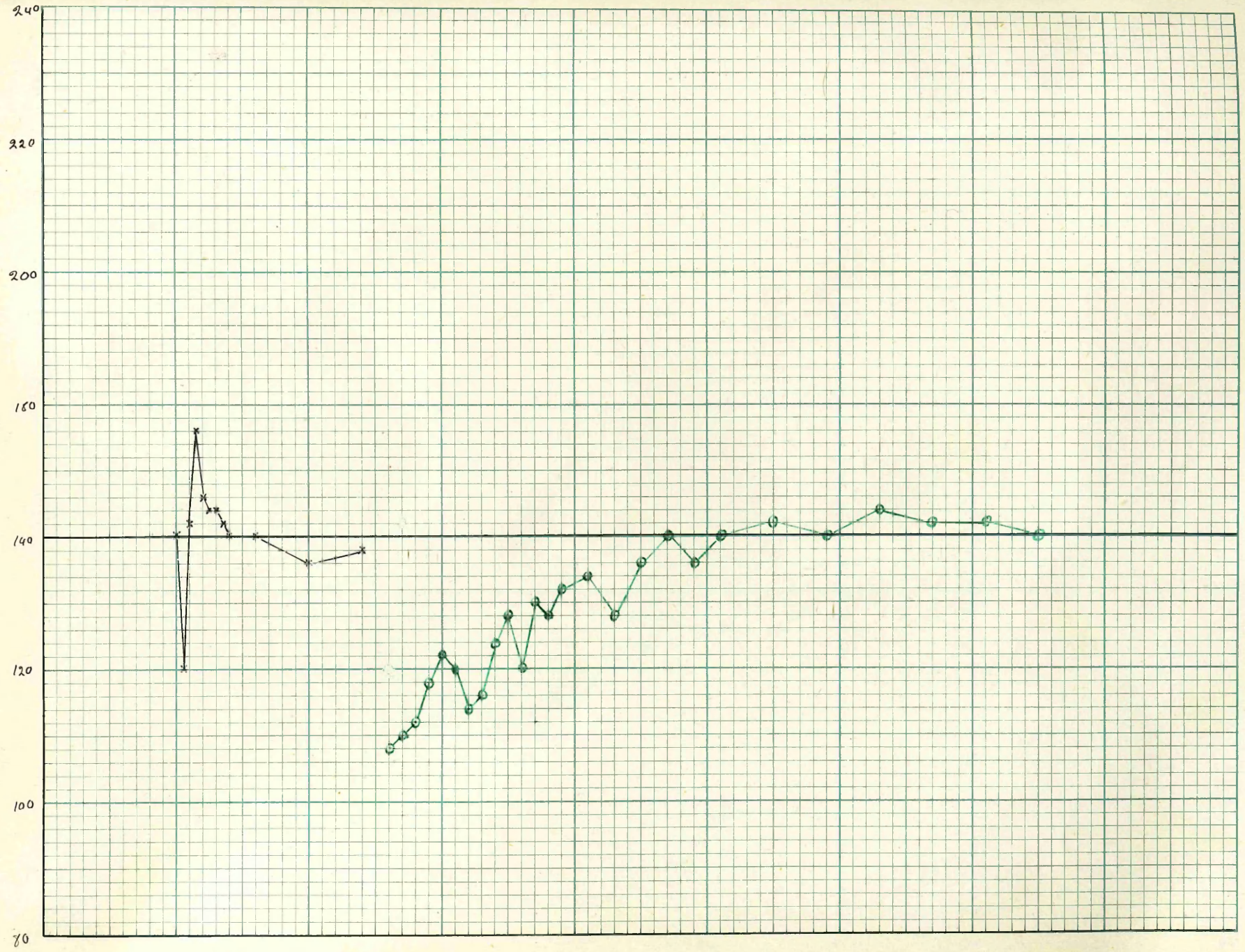
~~0161~~
0231

MATHEWS HB. DAY 1


240
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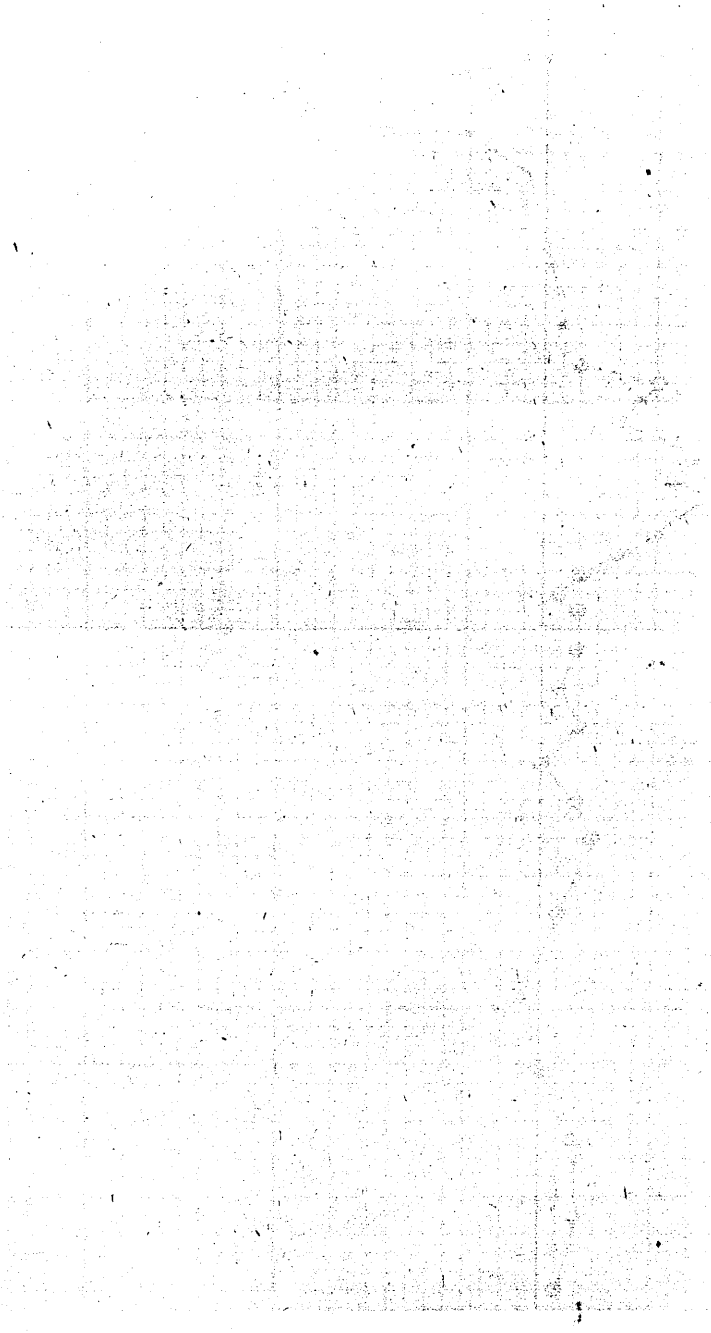
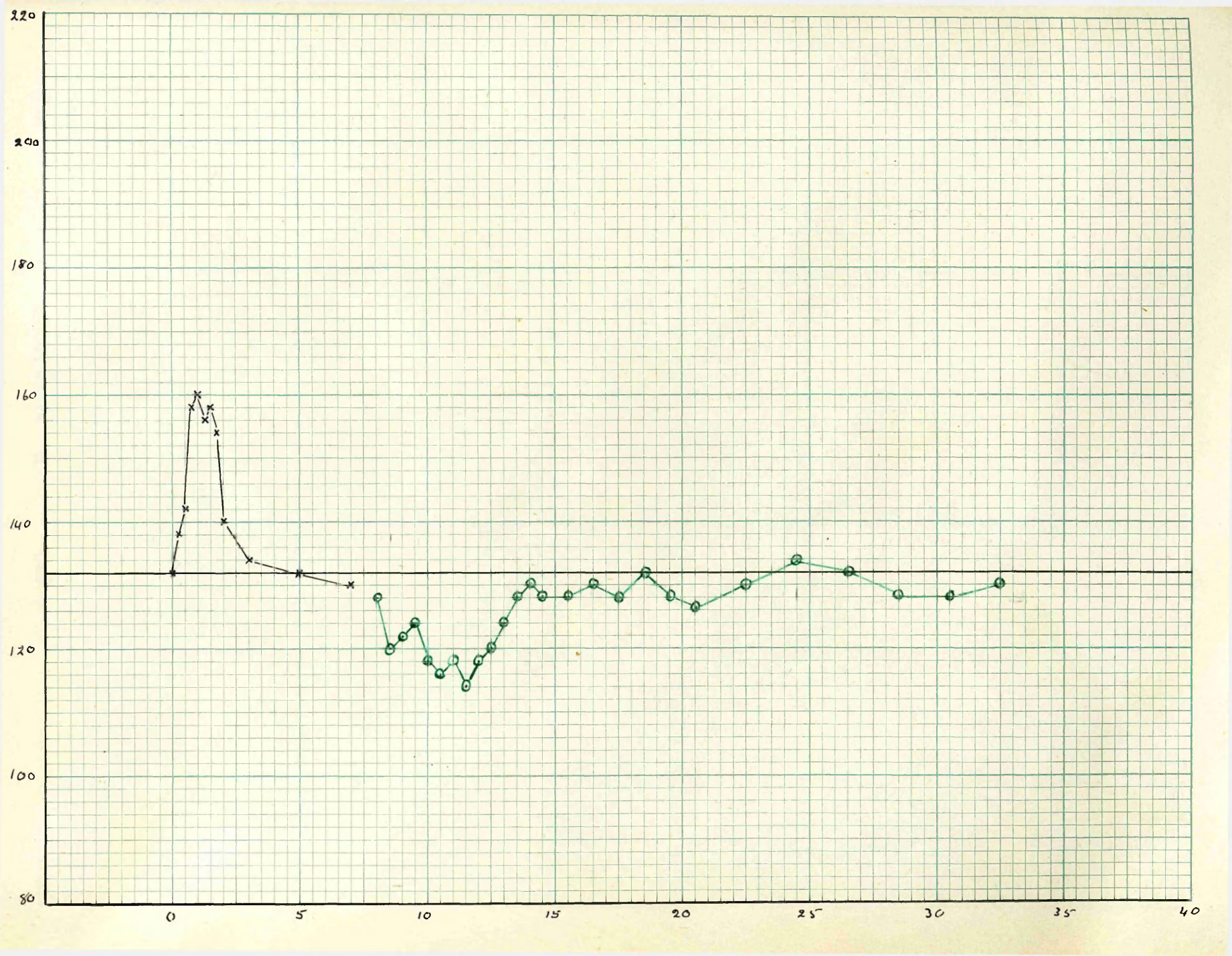
~~O-IH~~ MOOREHOUSE D DAY 1

0261

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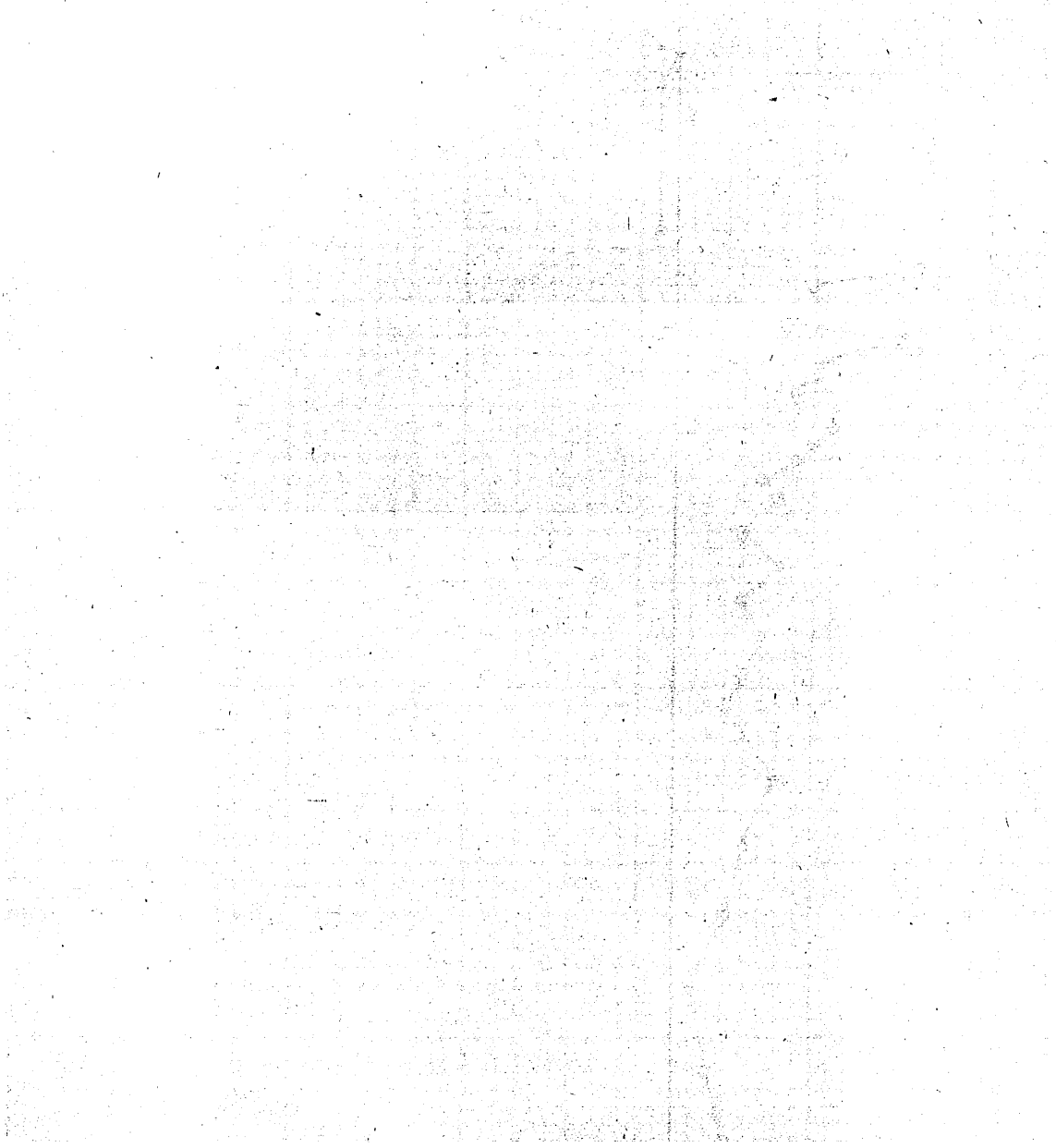

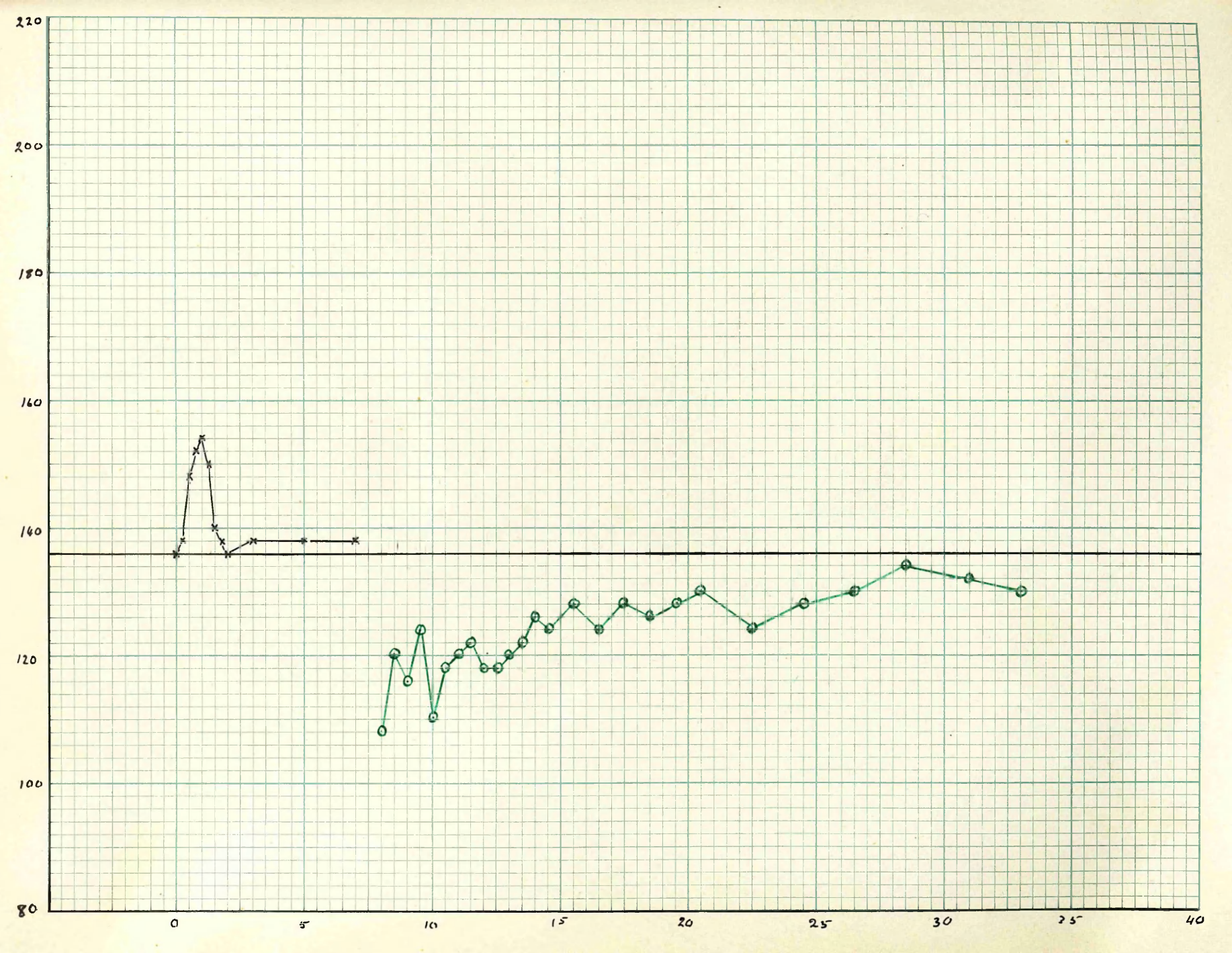
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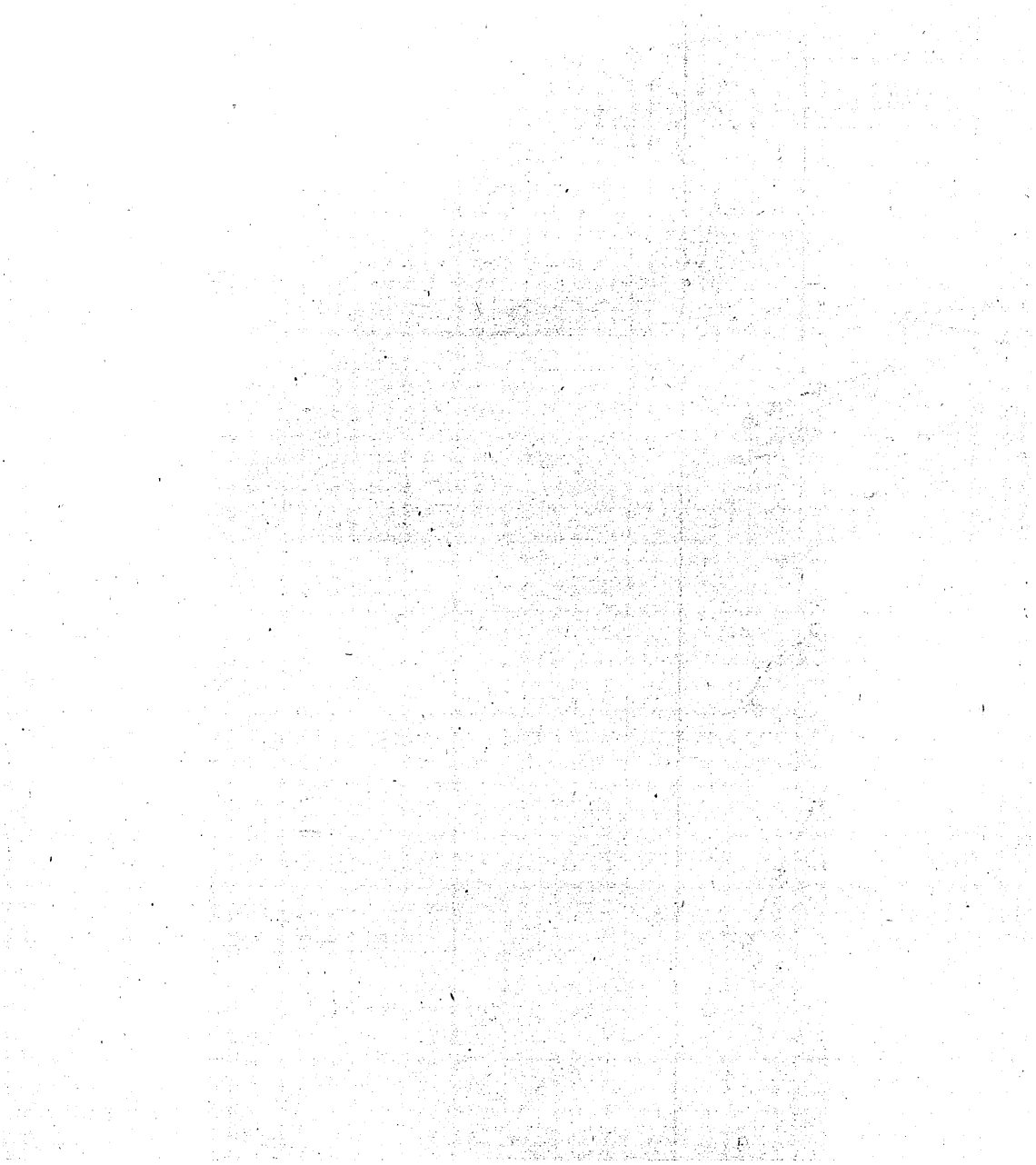

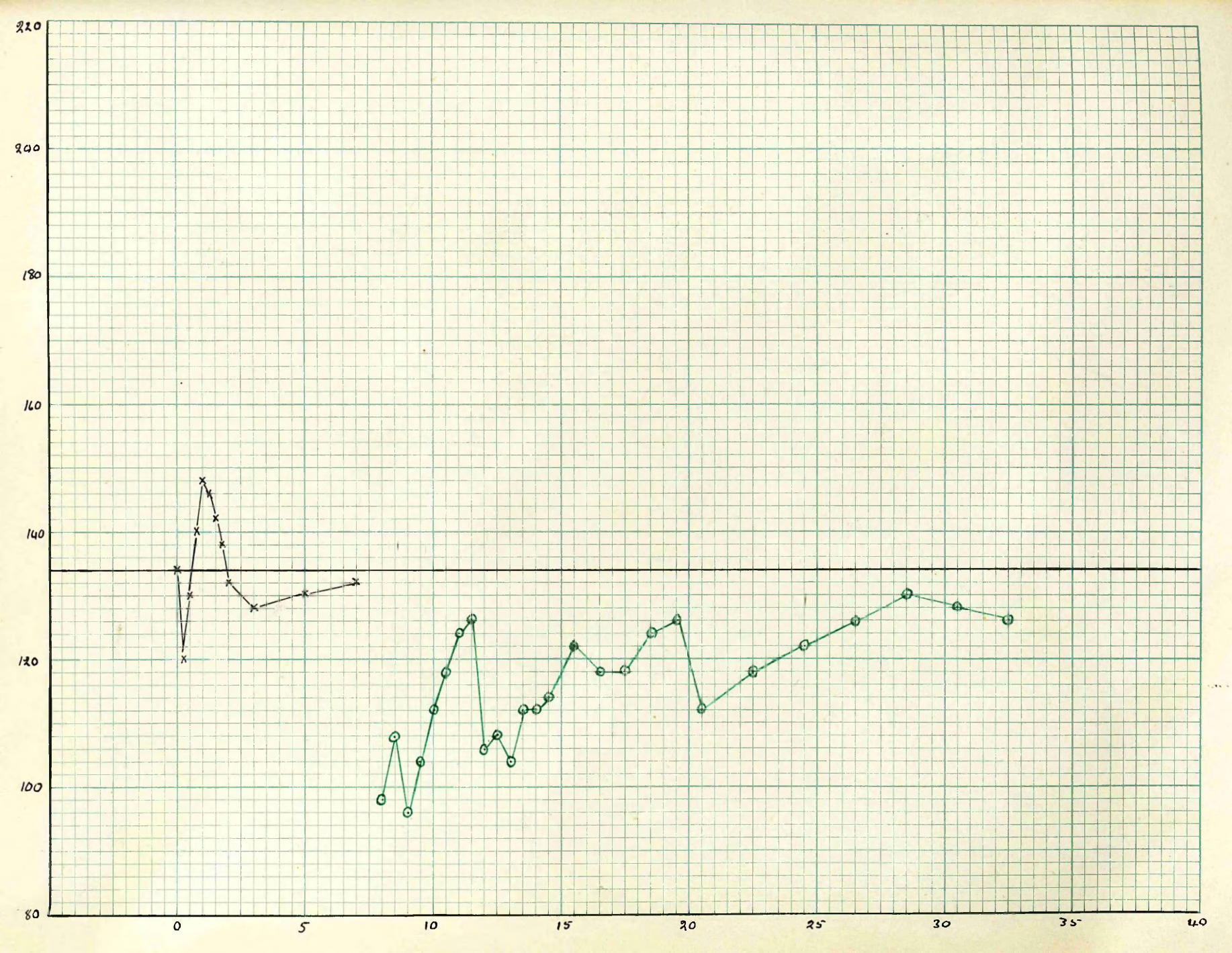
220
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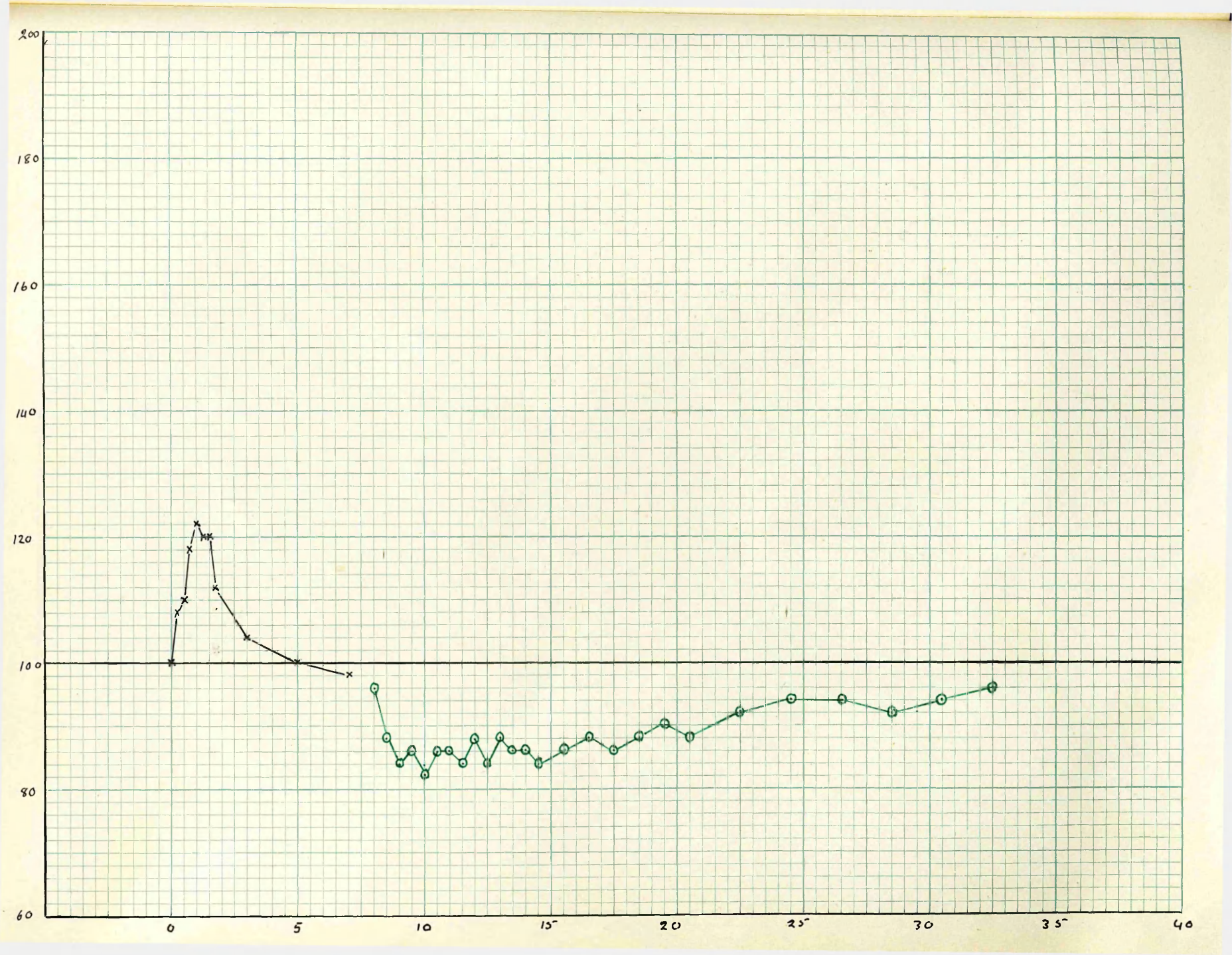
~~0141~~ GUY DAY 1

0291


200
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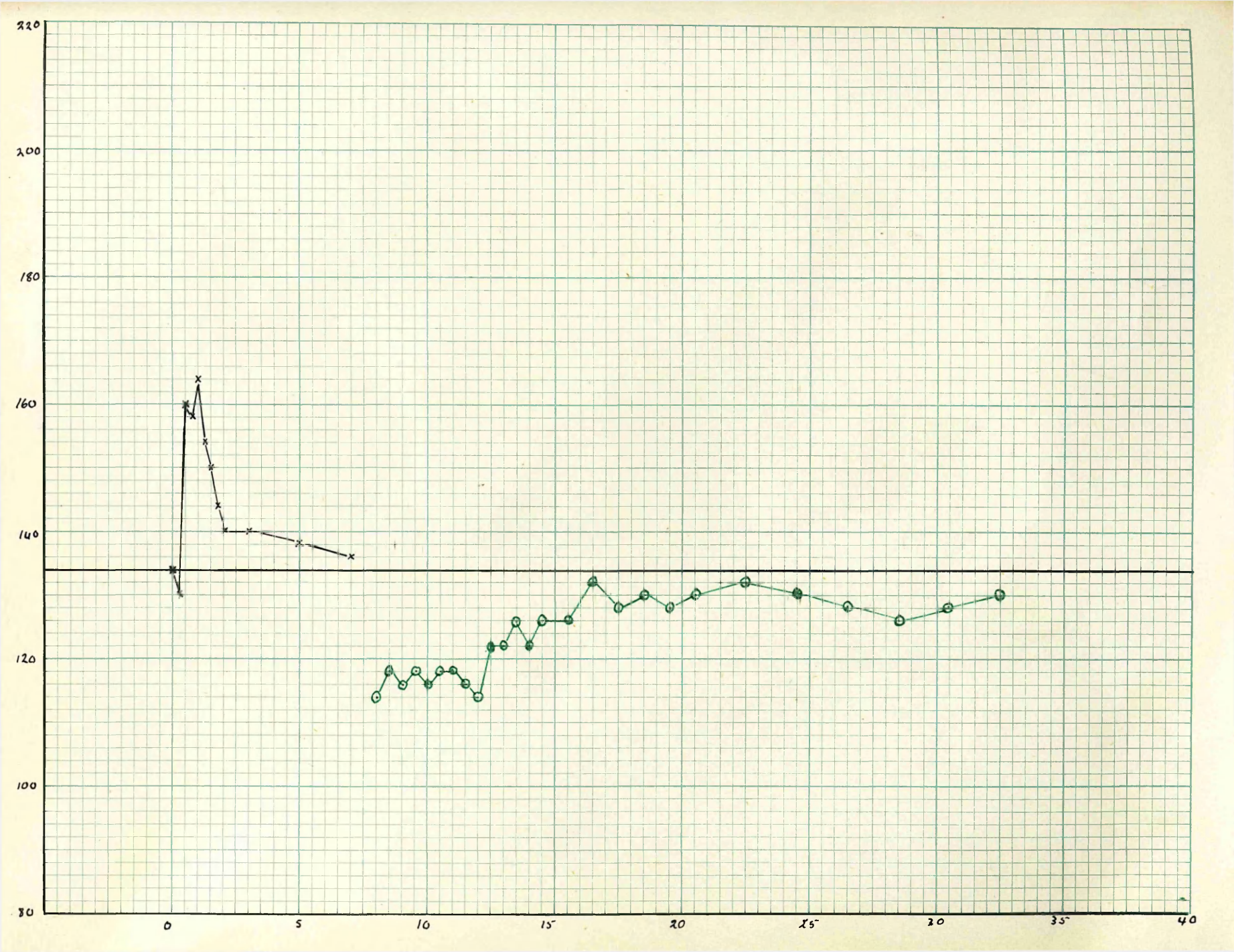
~~0151~~ GLOVER DAY 1

0301


220
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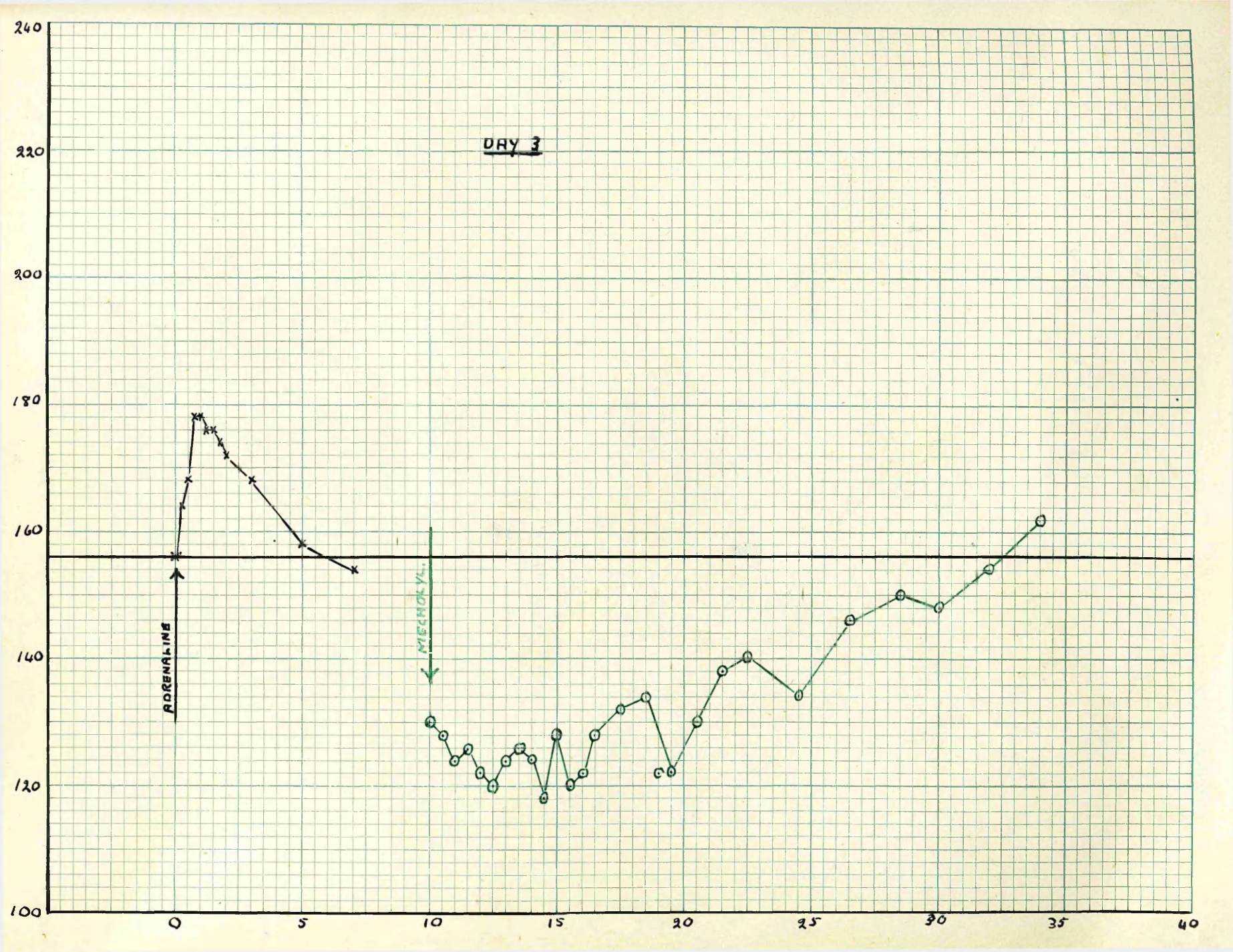
DEPRESSIVES TESTED AFTER A THREE-DAY INTERVAL.


DAY 3
240
220
200
180
160
140
120
100
0
5
10
15
20
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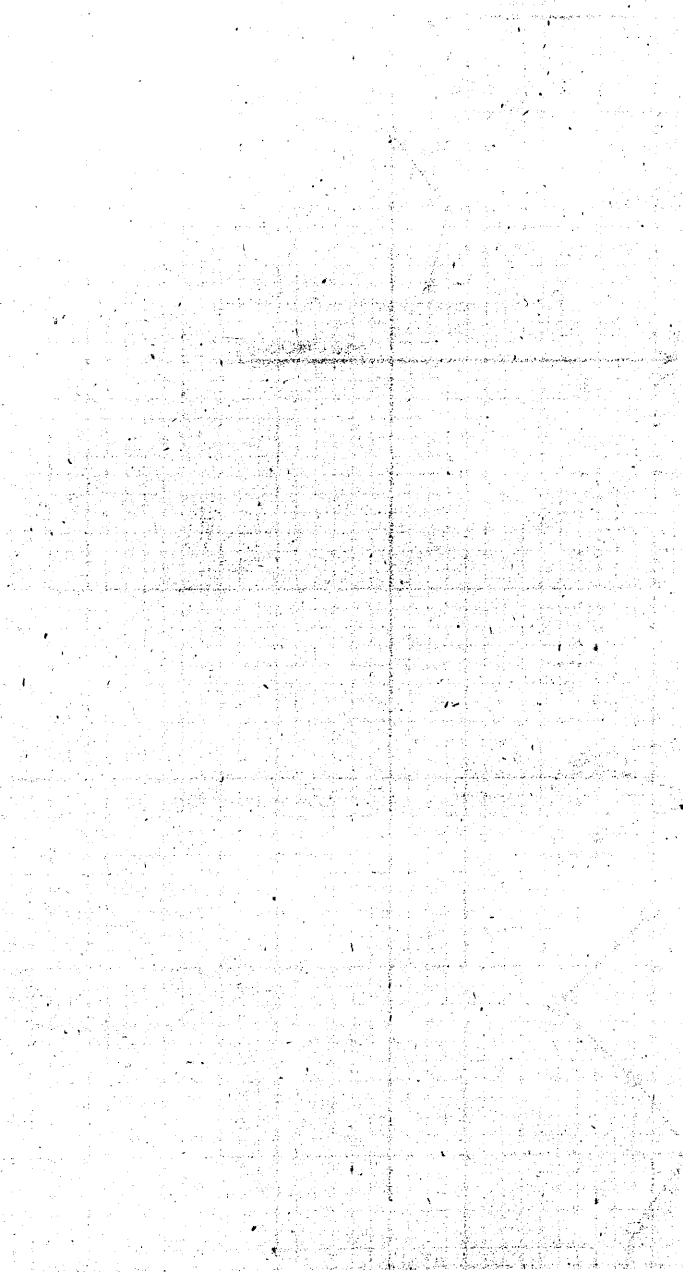
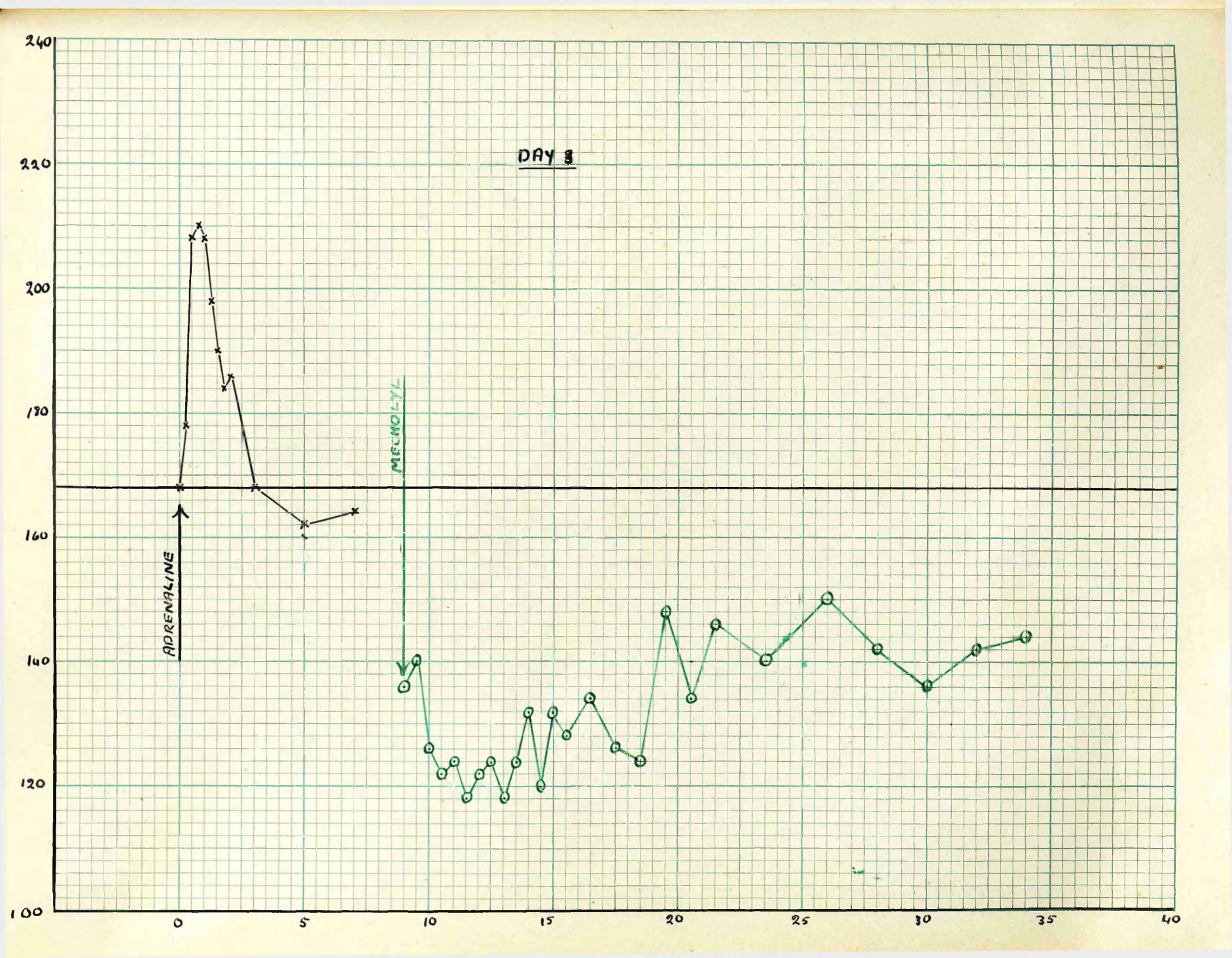
30
35
40
ADRENALINE
MECHOLYL.

~~0022~~
0032

GILLA DAY 3.




DAY 8
240
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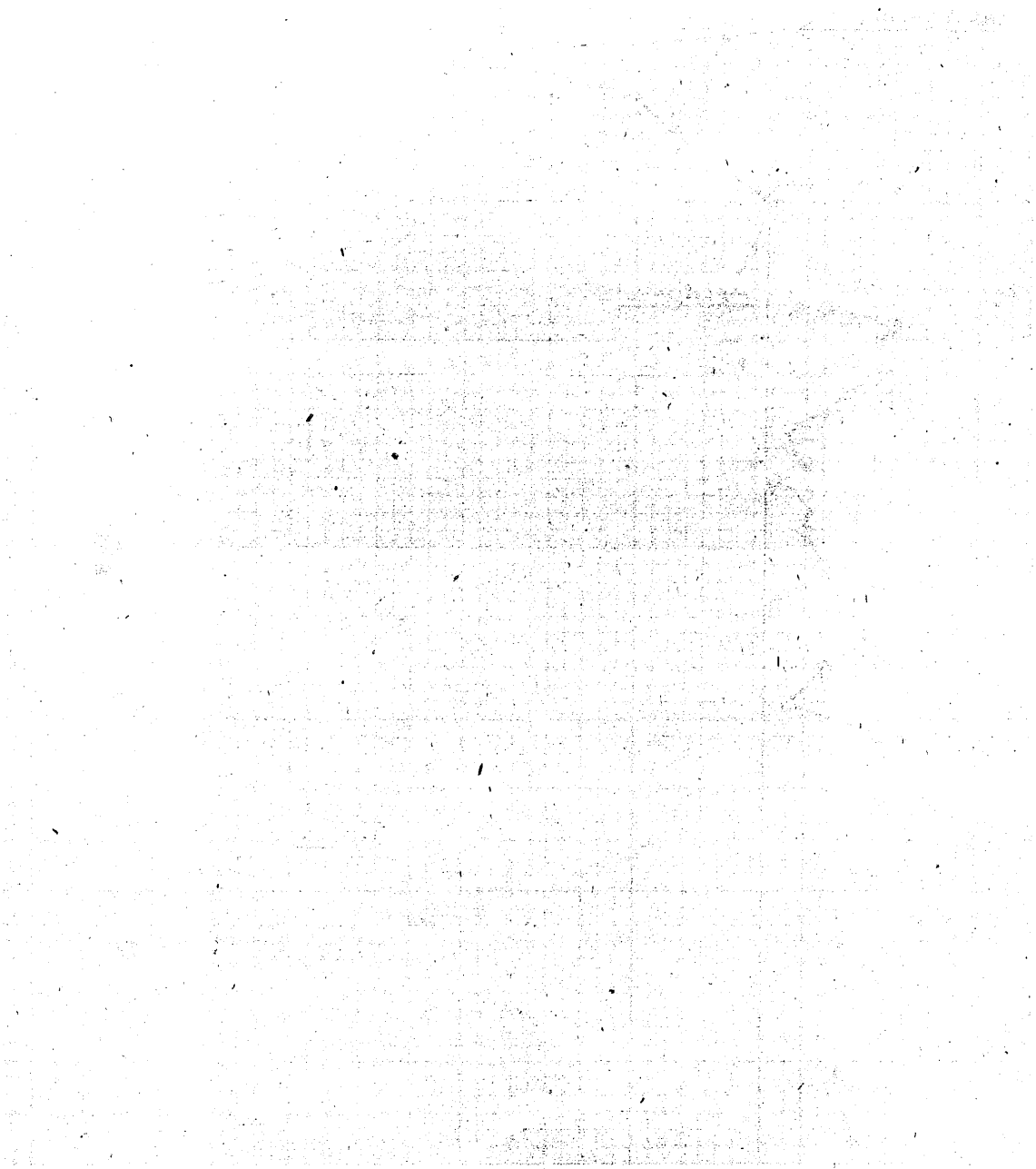
ADRENALINE
MECHOLYL

~~0032~~ 0052 WALTERS A. ~~MECHOLYL~~ DAY 3.




DAY 5
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ADRENALINE
MECHOLYL
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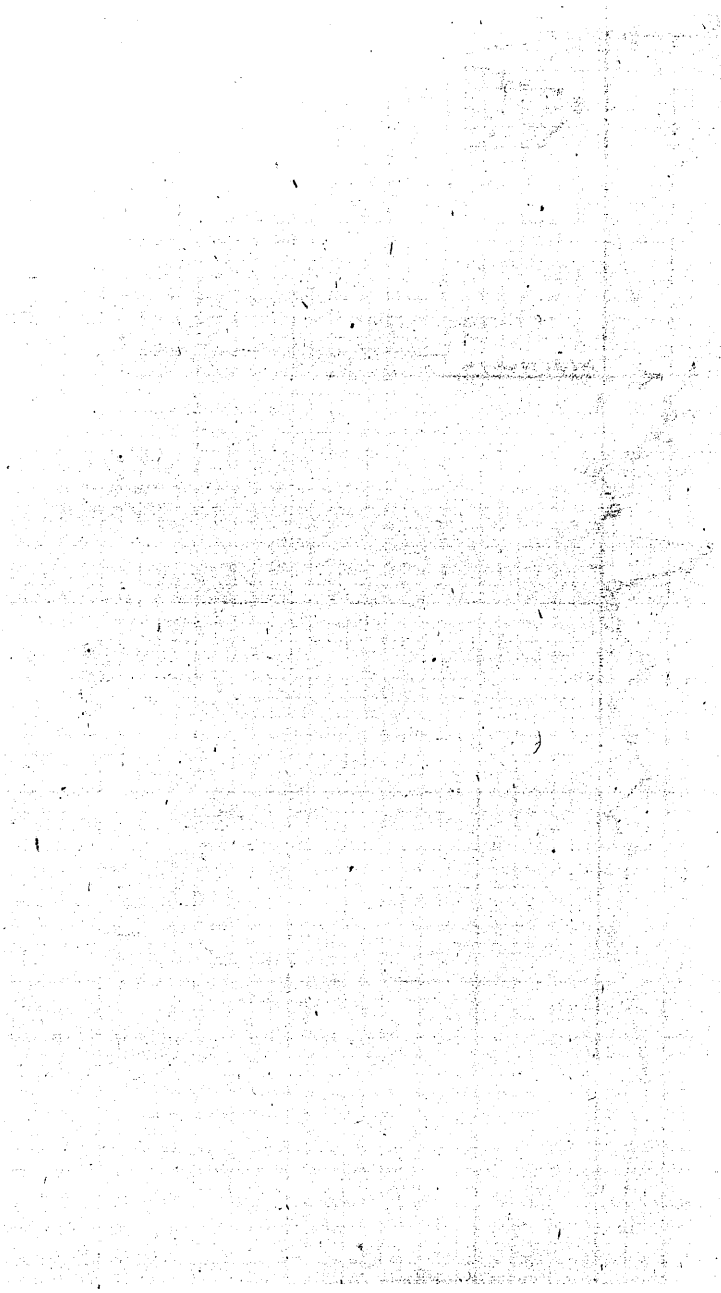

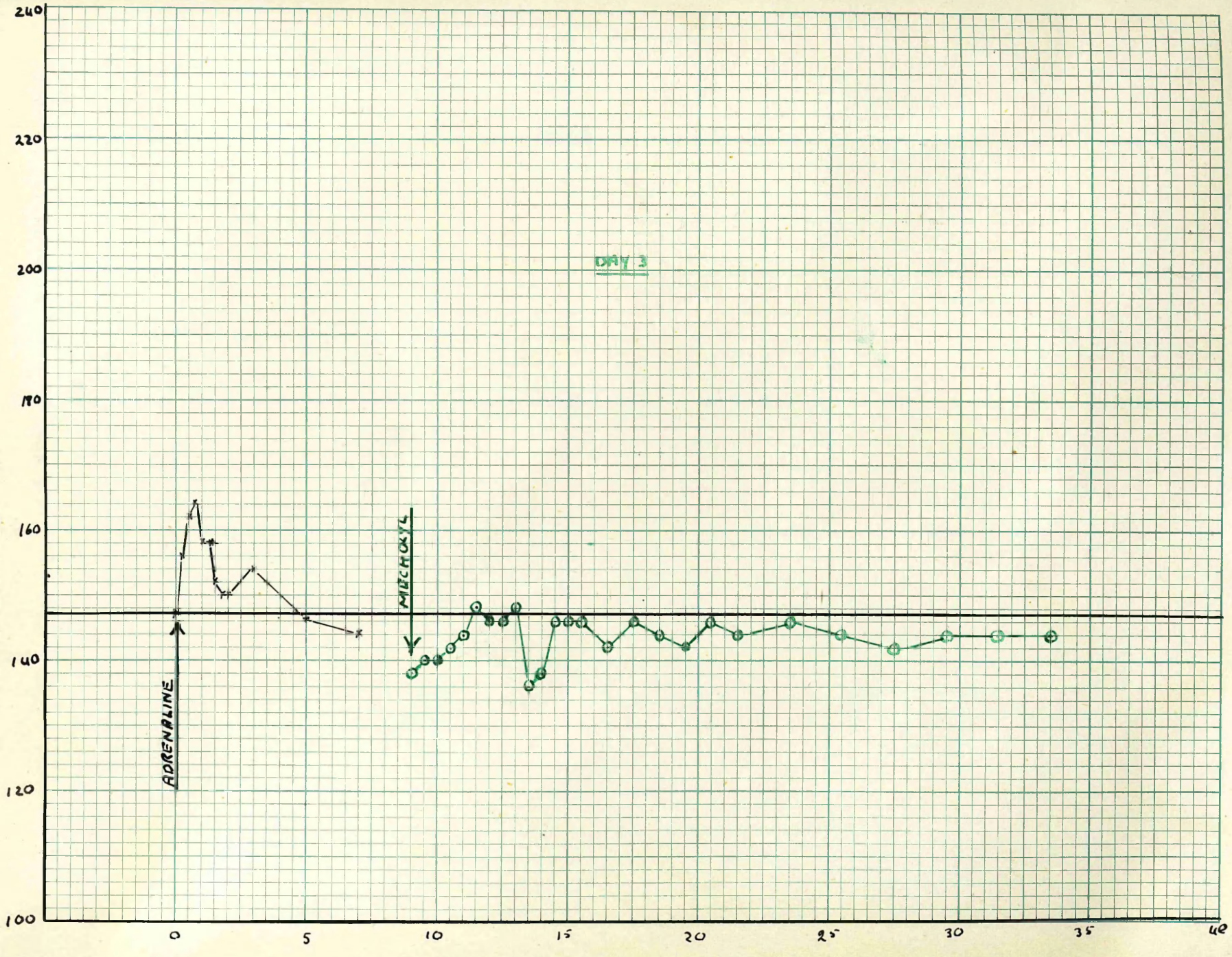
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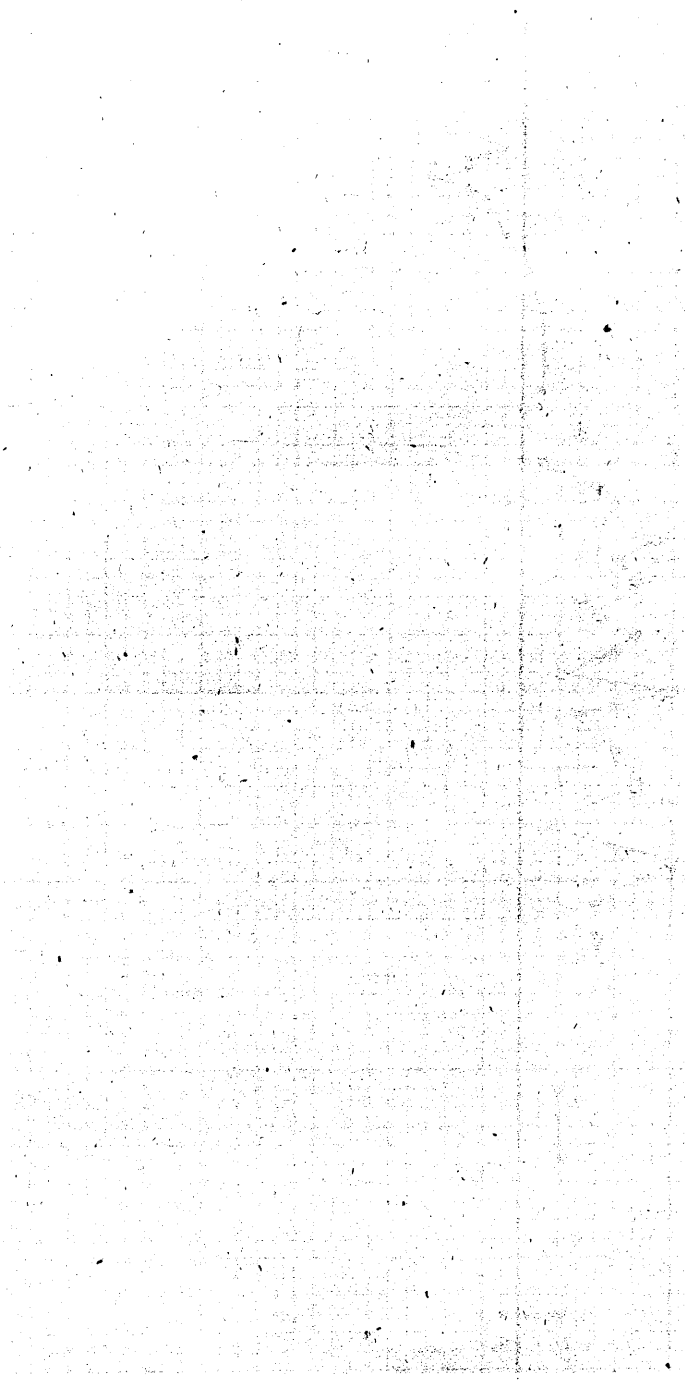
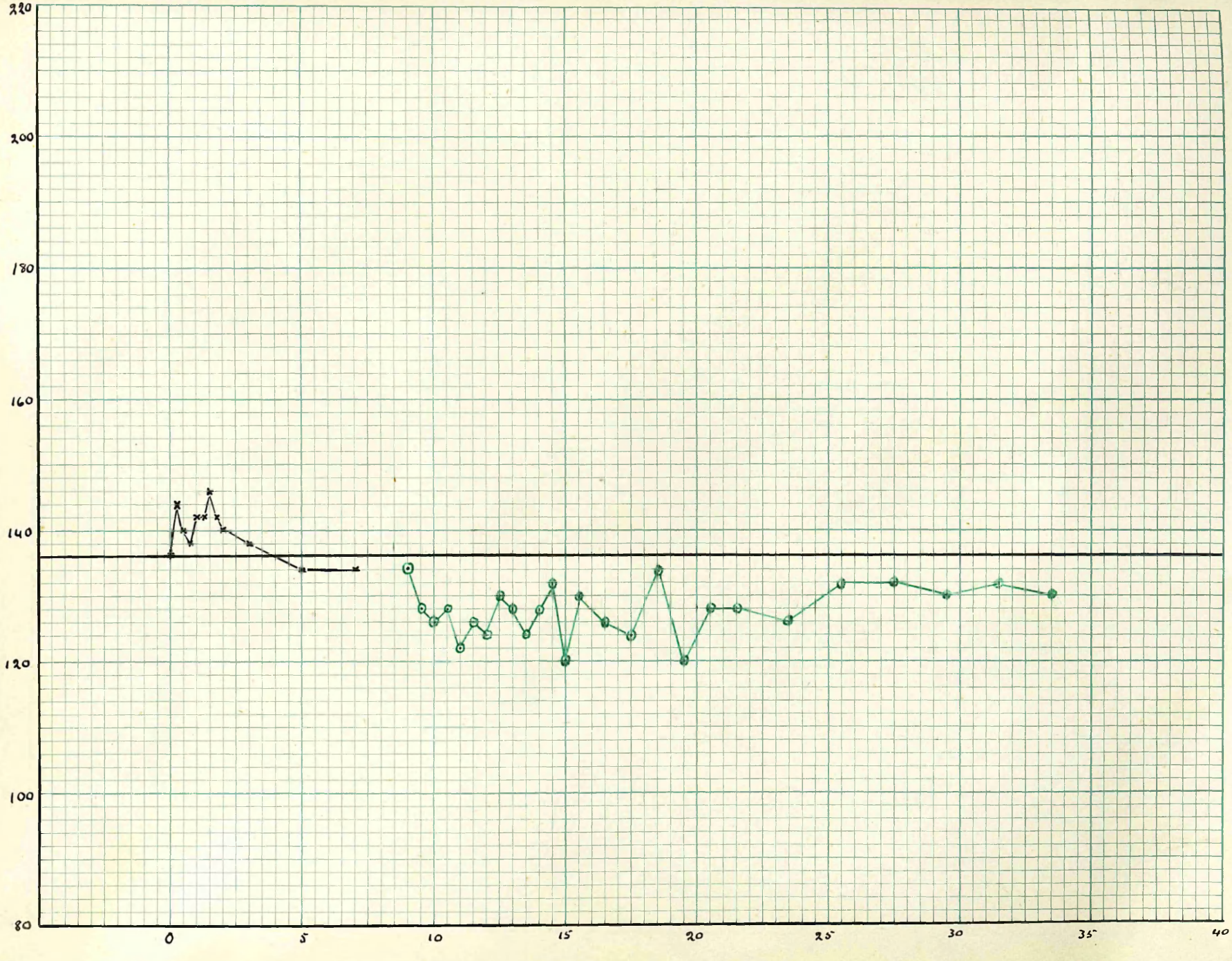
DAY 3
ADRENALINE
MECHOKYL

BATLEY T I DAY 3

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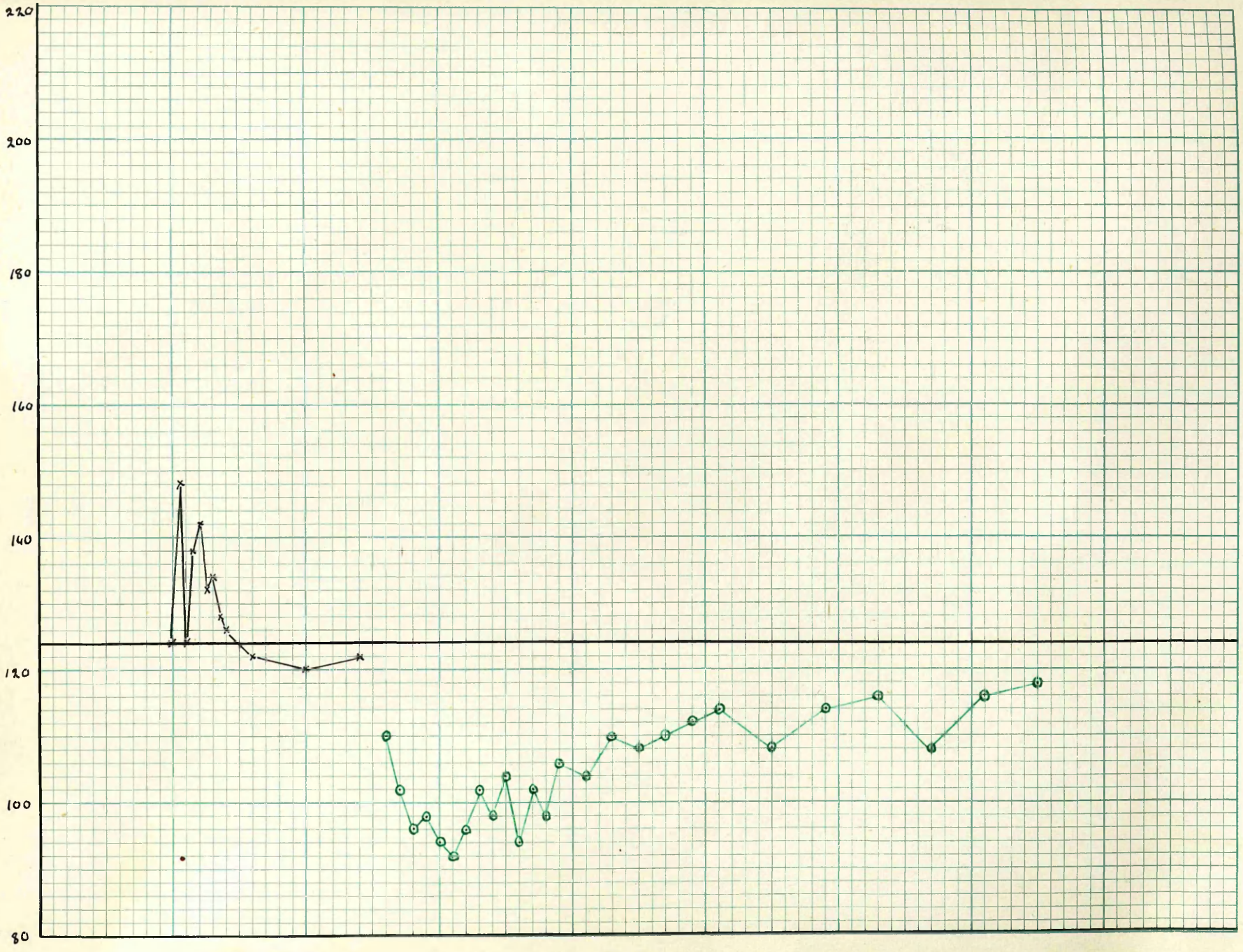
PURCHON A DAY 3.

0102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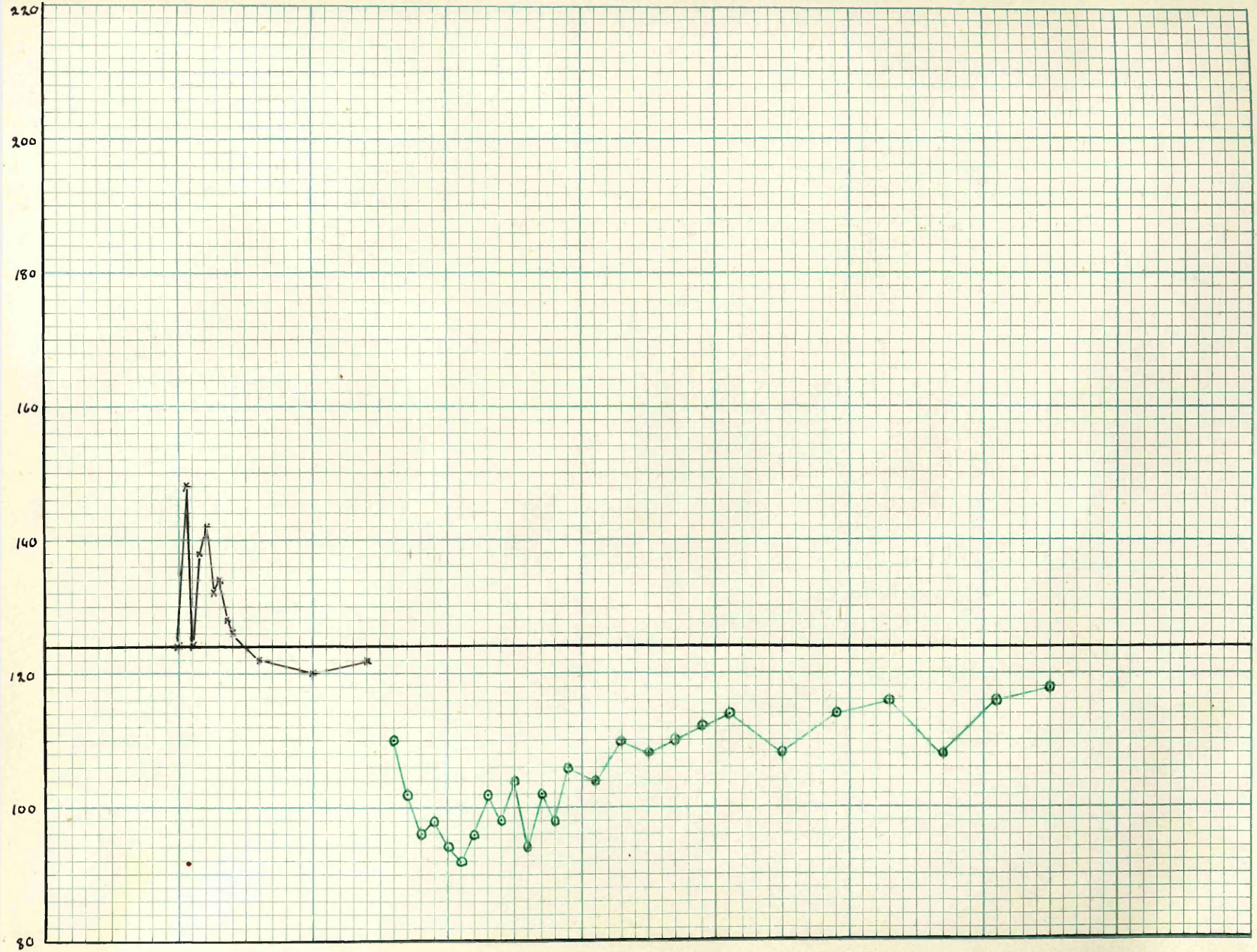
0132

BRADBURY·D DAY 3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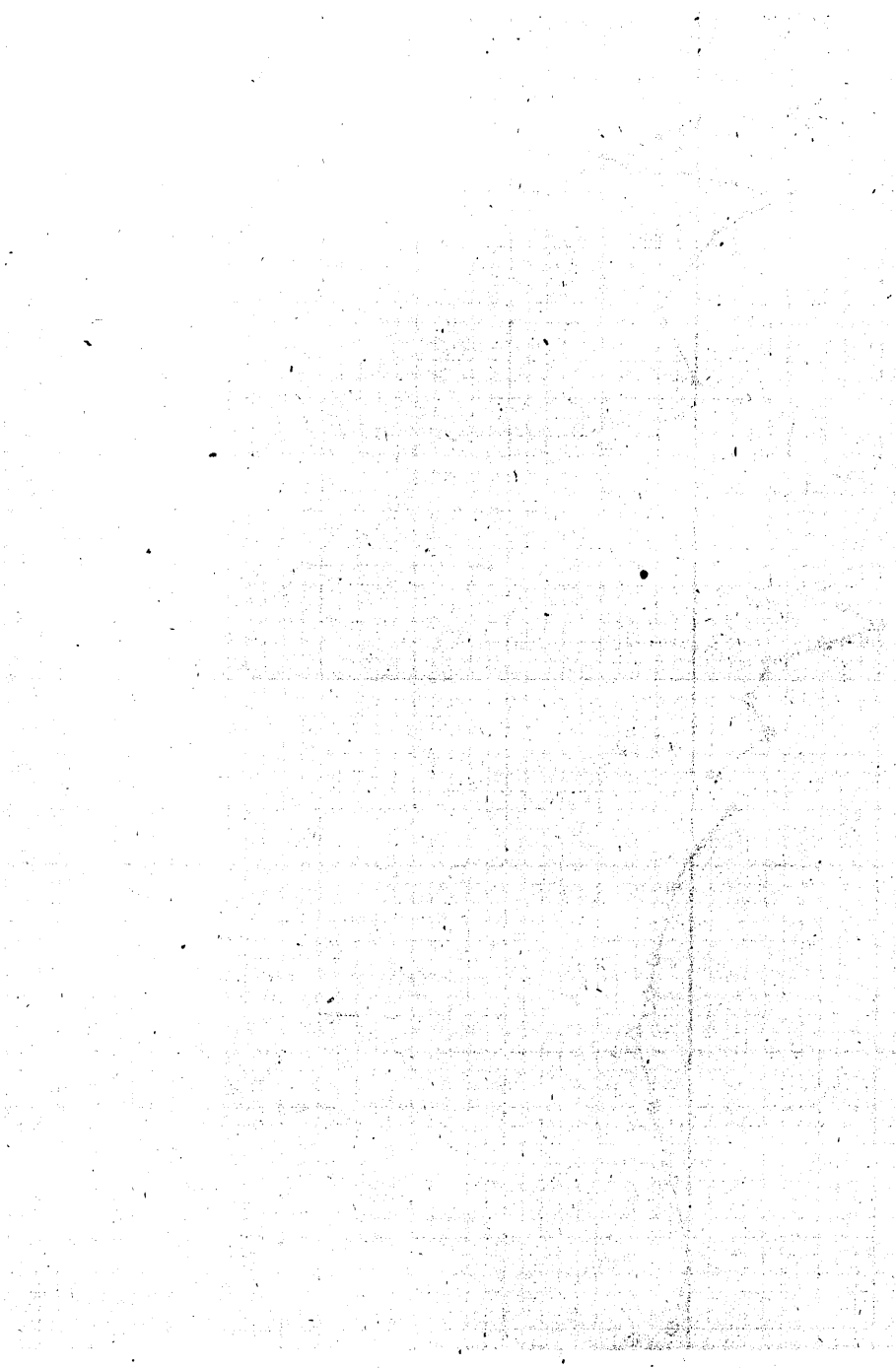
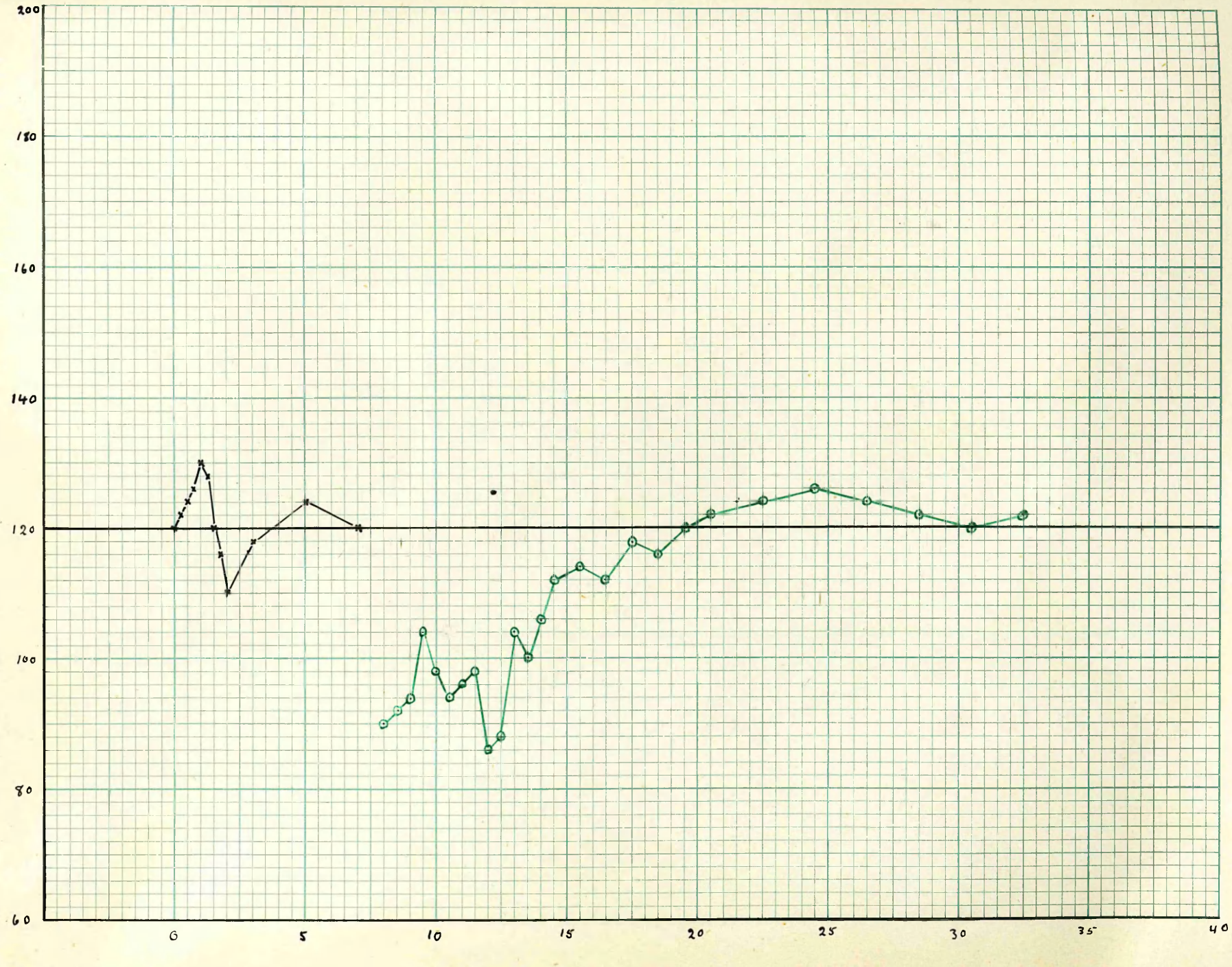
BRADBURY D DAY 3

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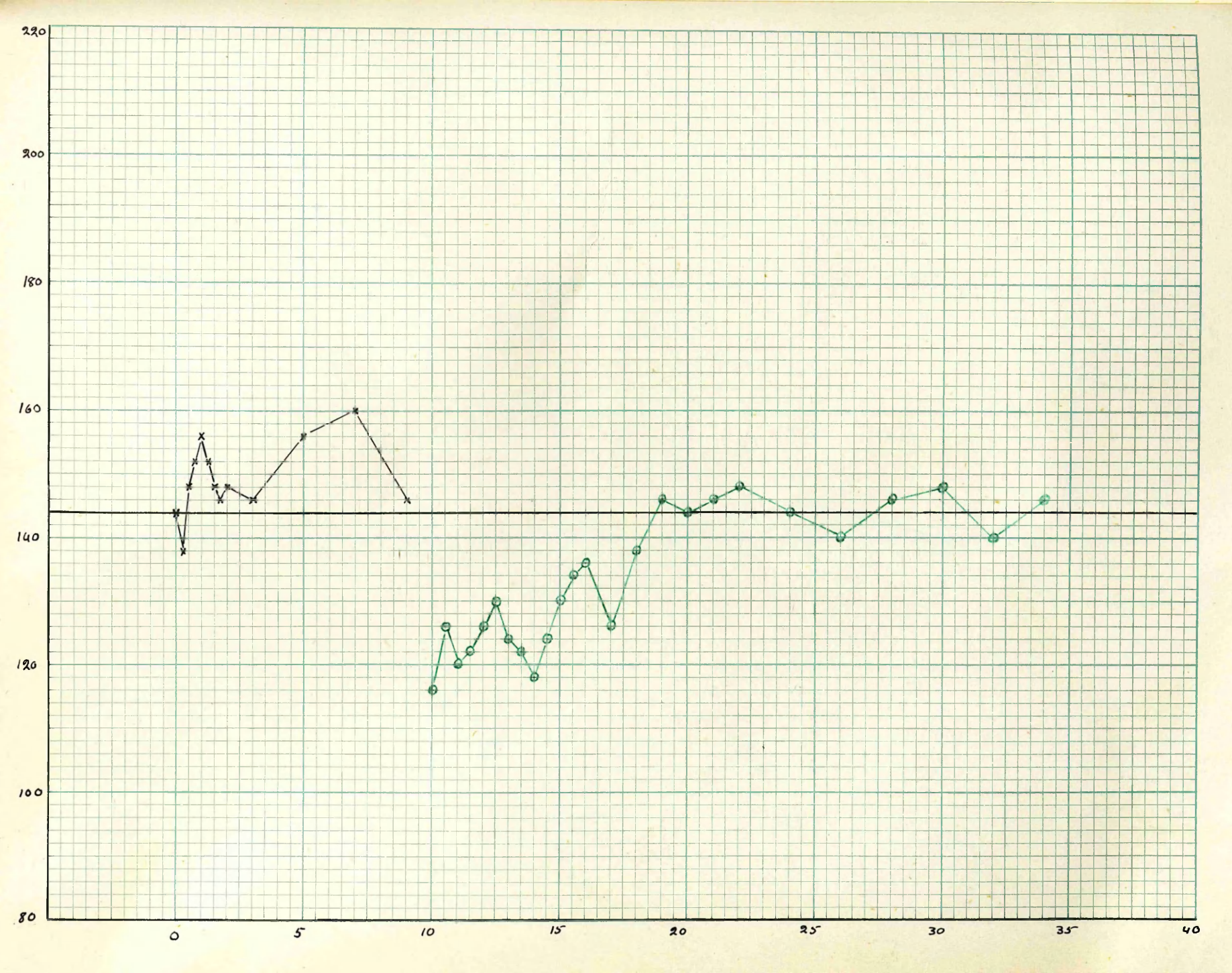
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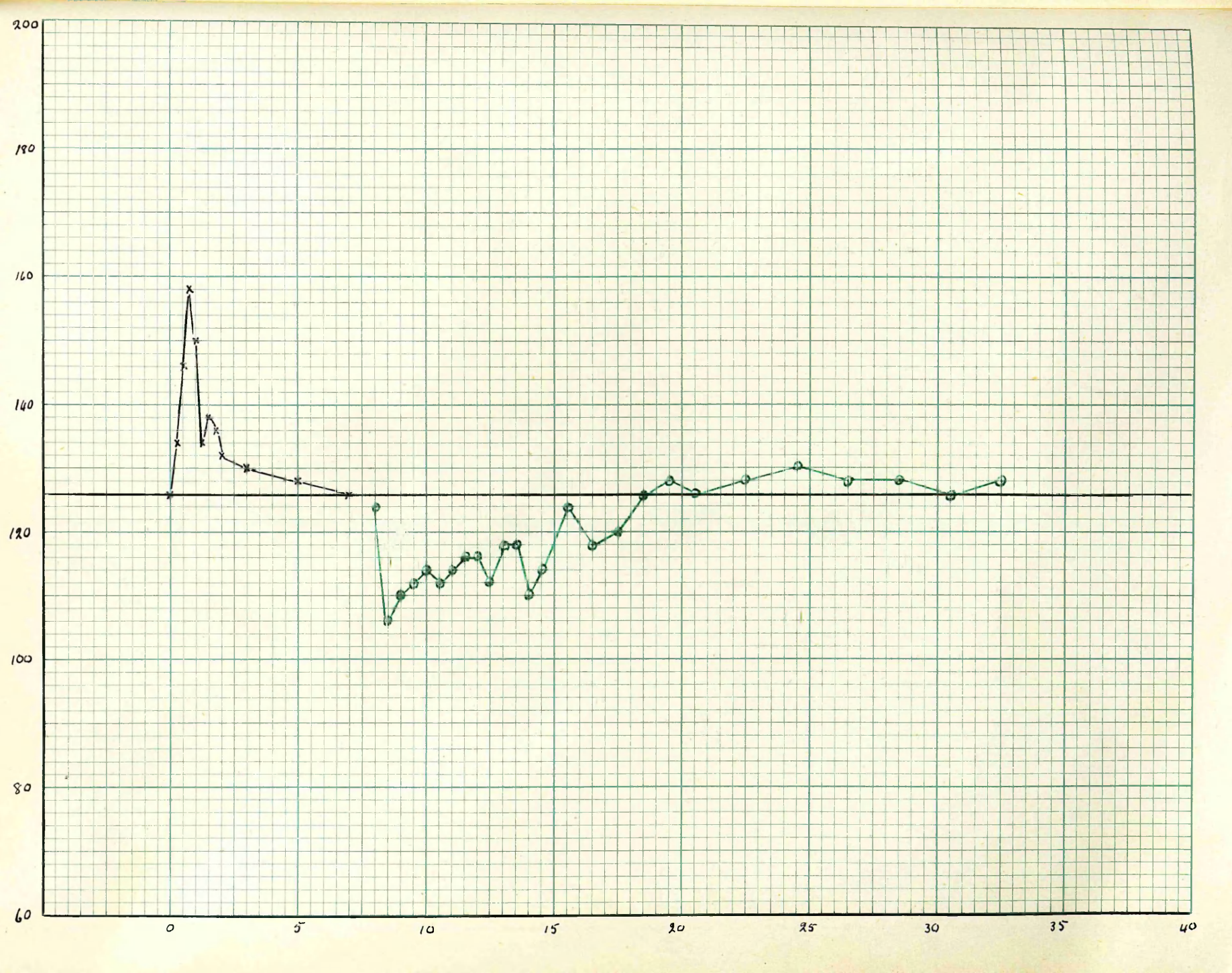
~~0092~~ WOOD S DAY3

0162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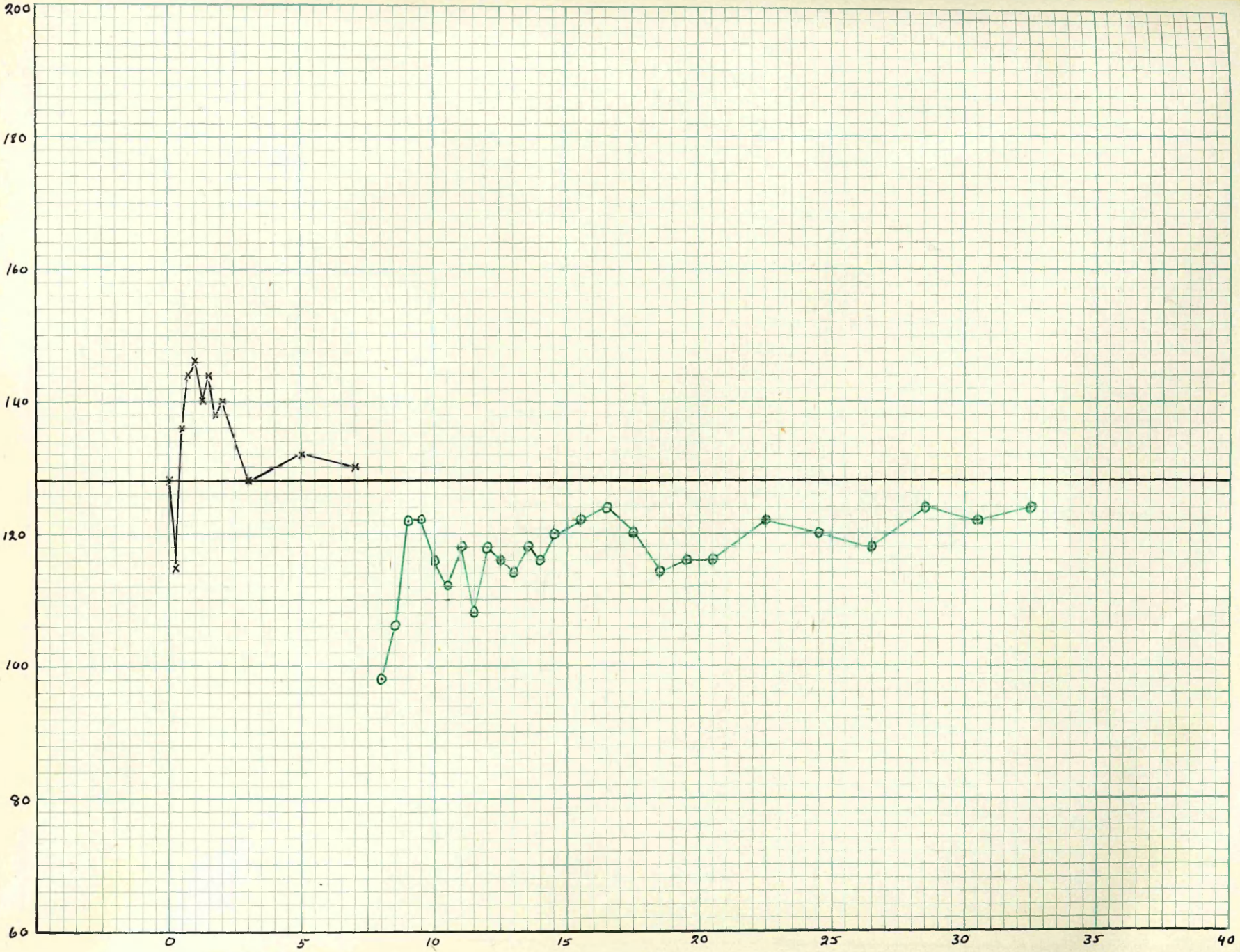
~~0102~~ SCOTT H DAY 3

0172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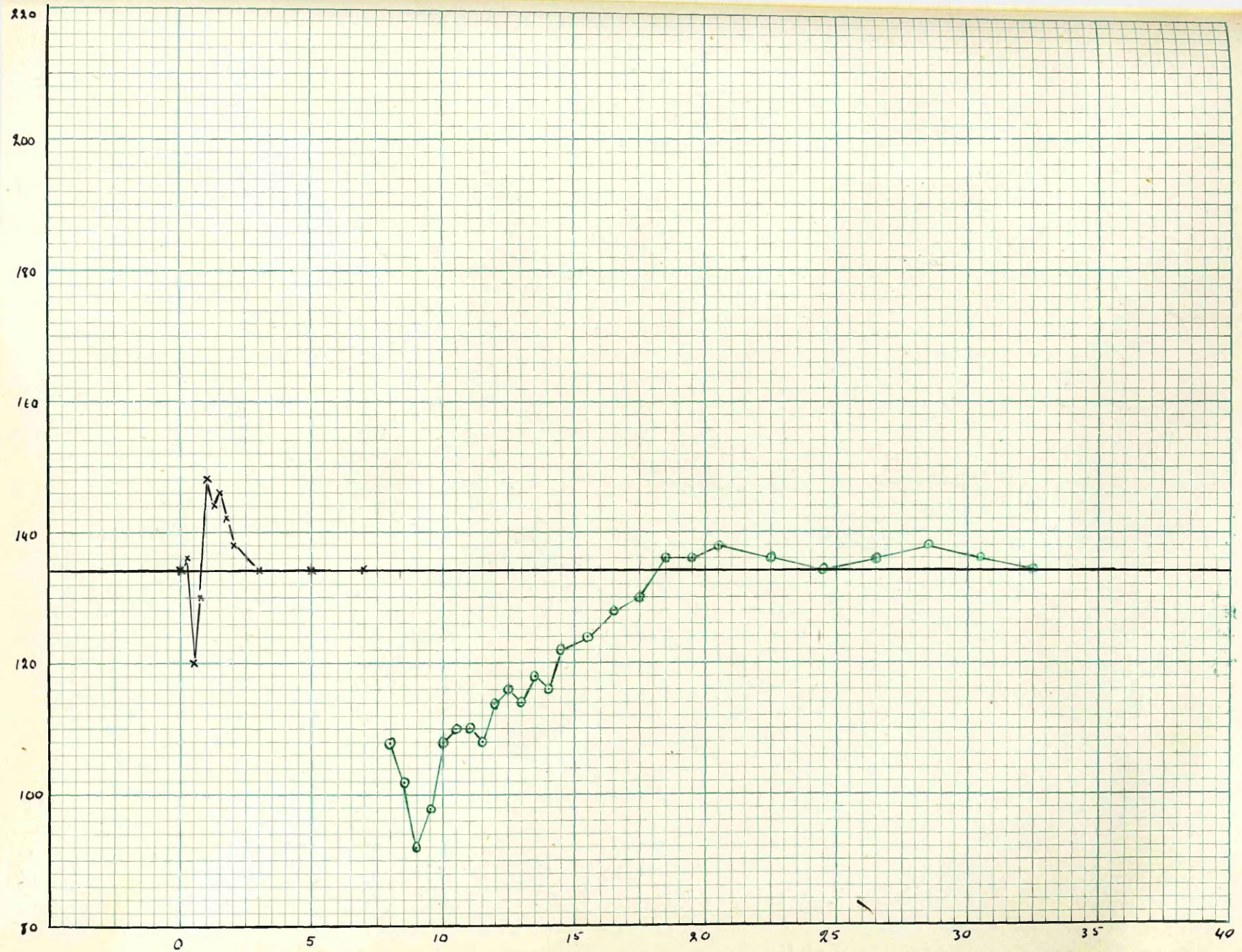
0182

FISHER WT DAYS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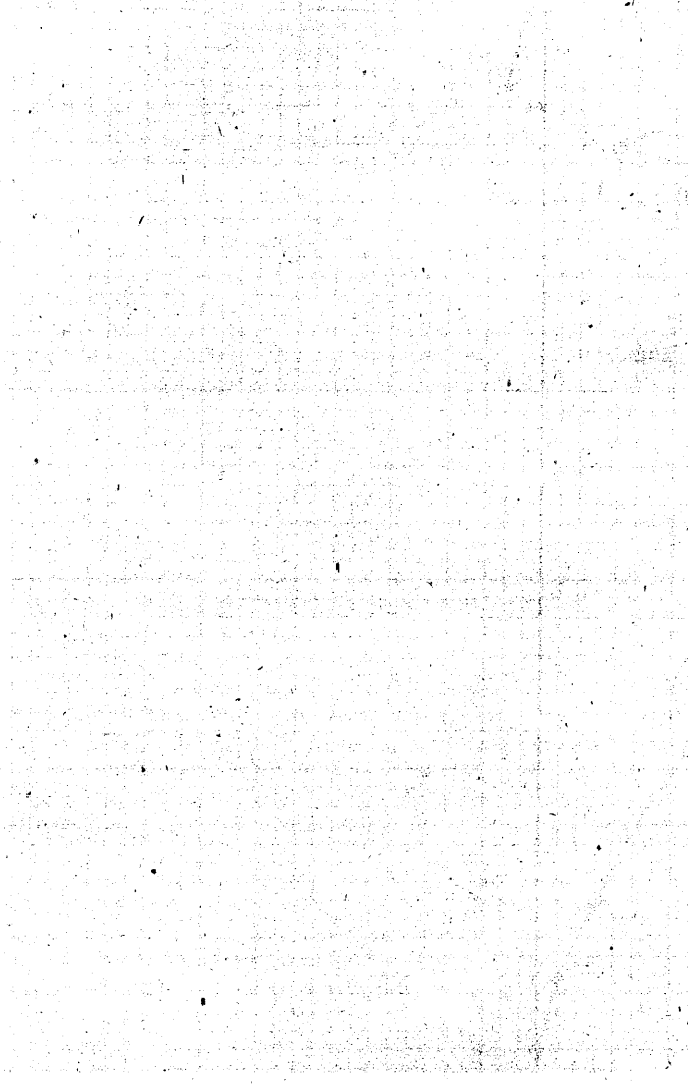

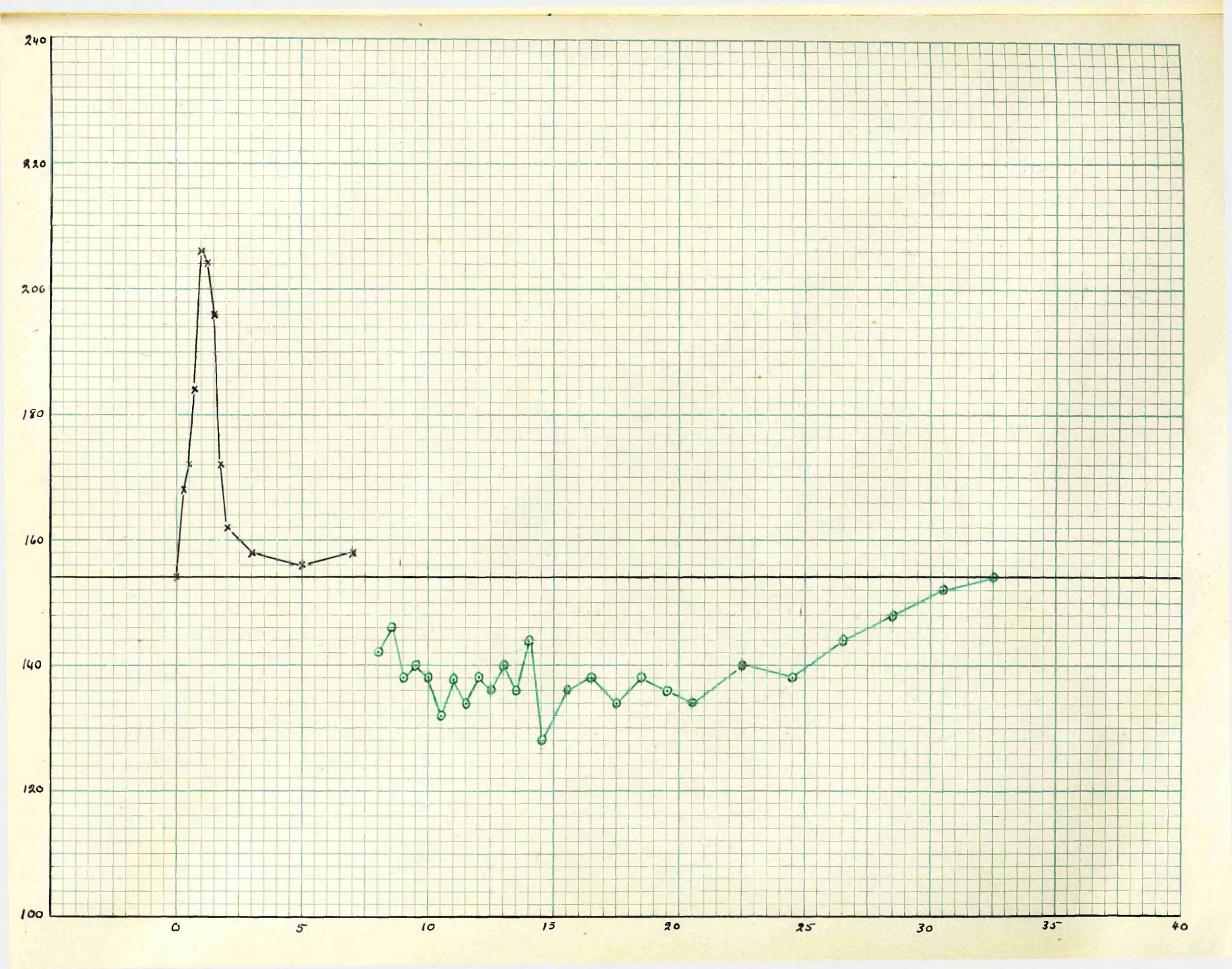
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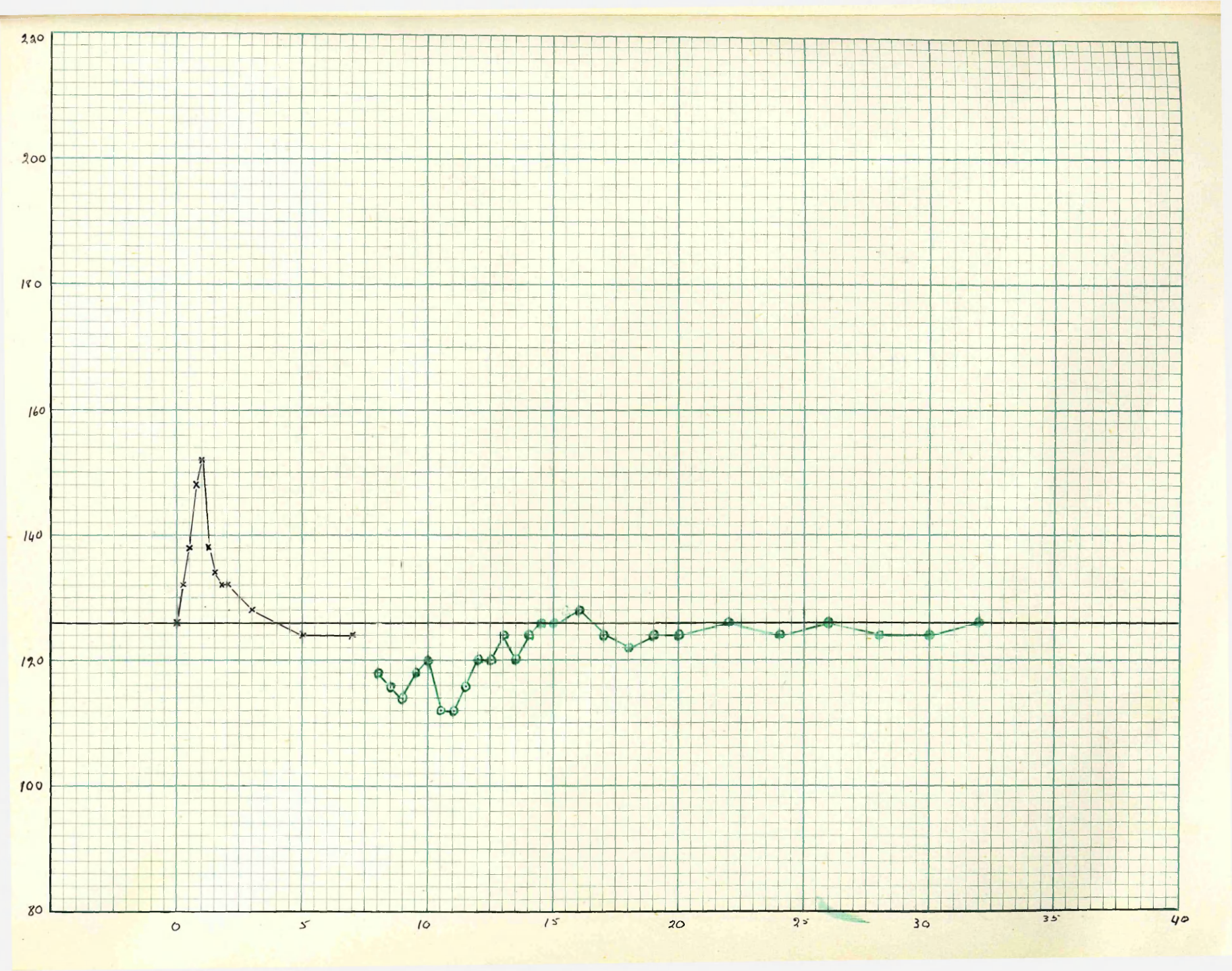
0222

STONES A DAY 3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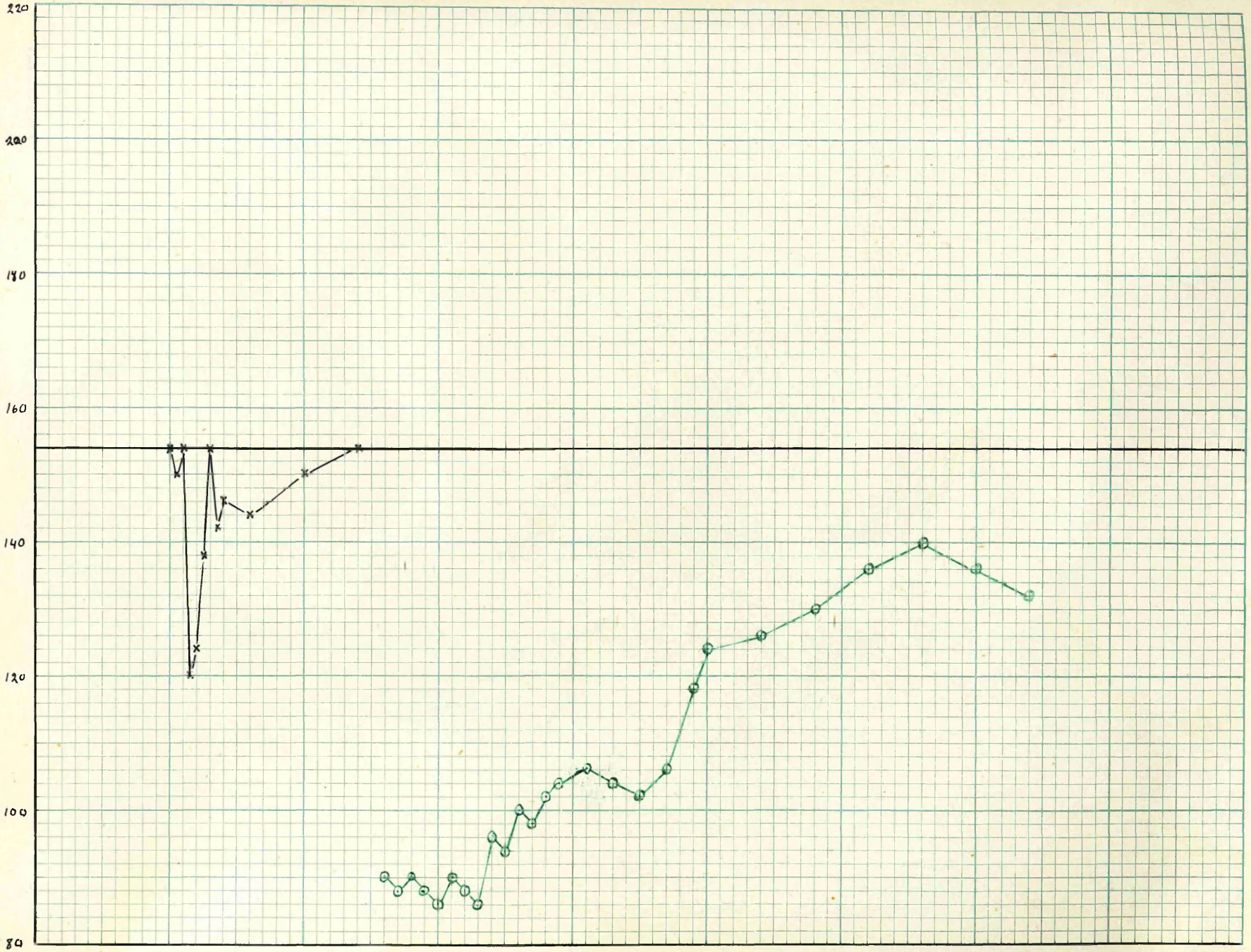
LAVERACK L DAY 3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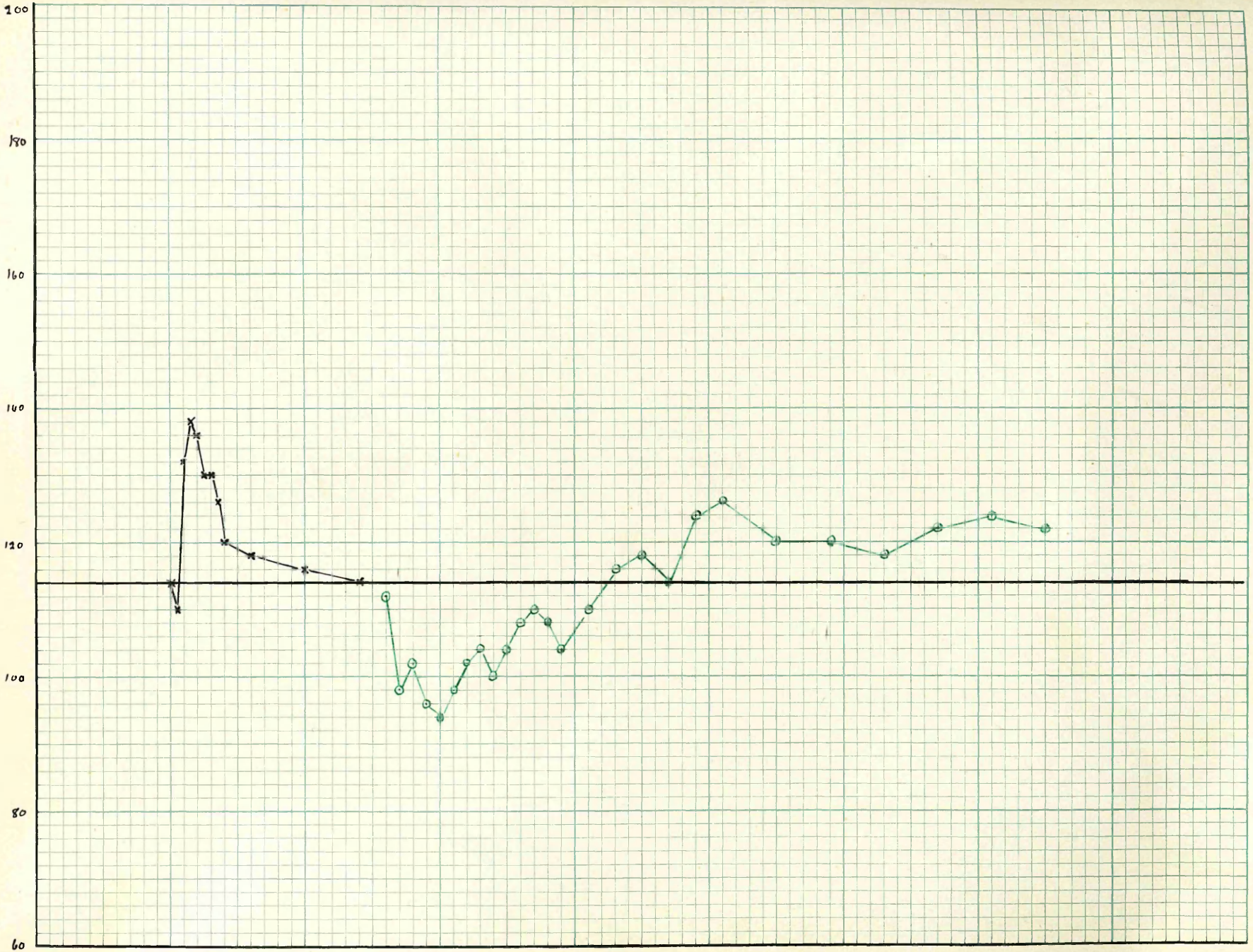
0252

THORNTON WI DAY 3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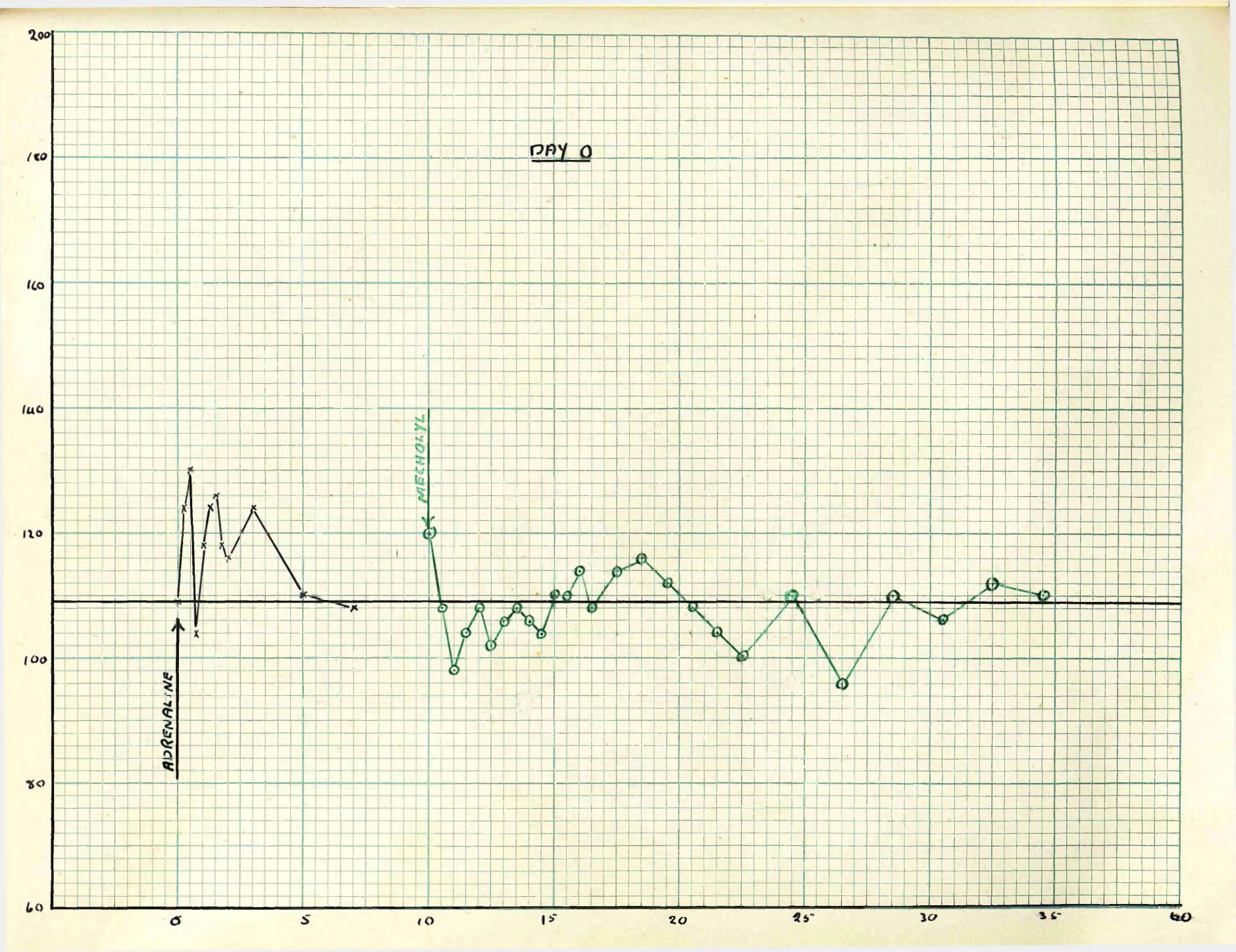
SCHIZOPHRENICS TESTED FOR THE FIRST TIME.


DAY 0
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ADRENALINE
METHOXYL
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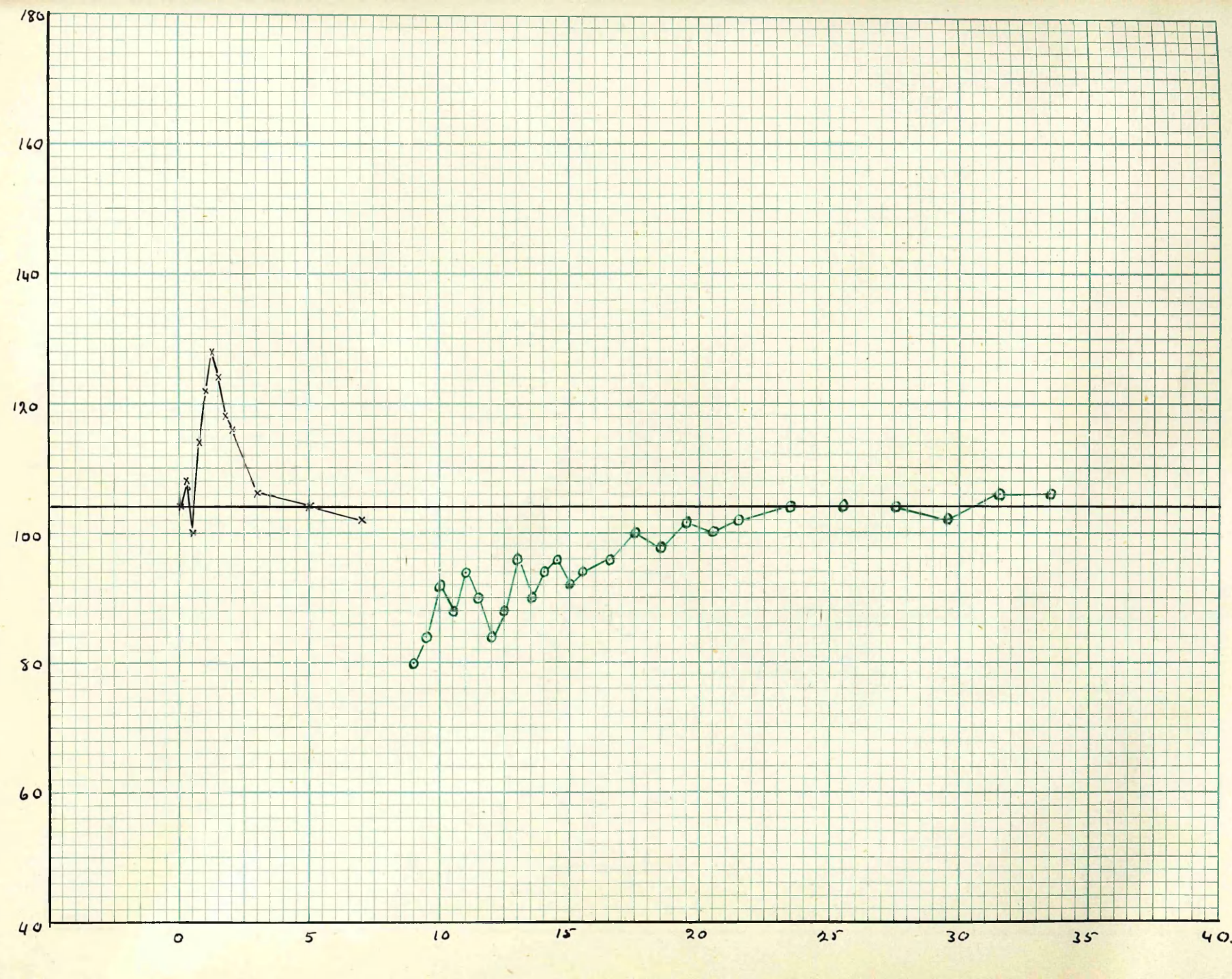
1020 AVEYARD R.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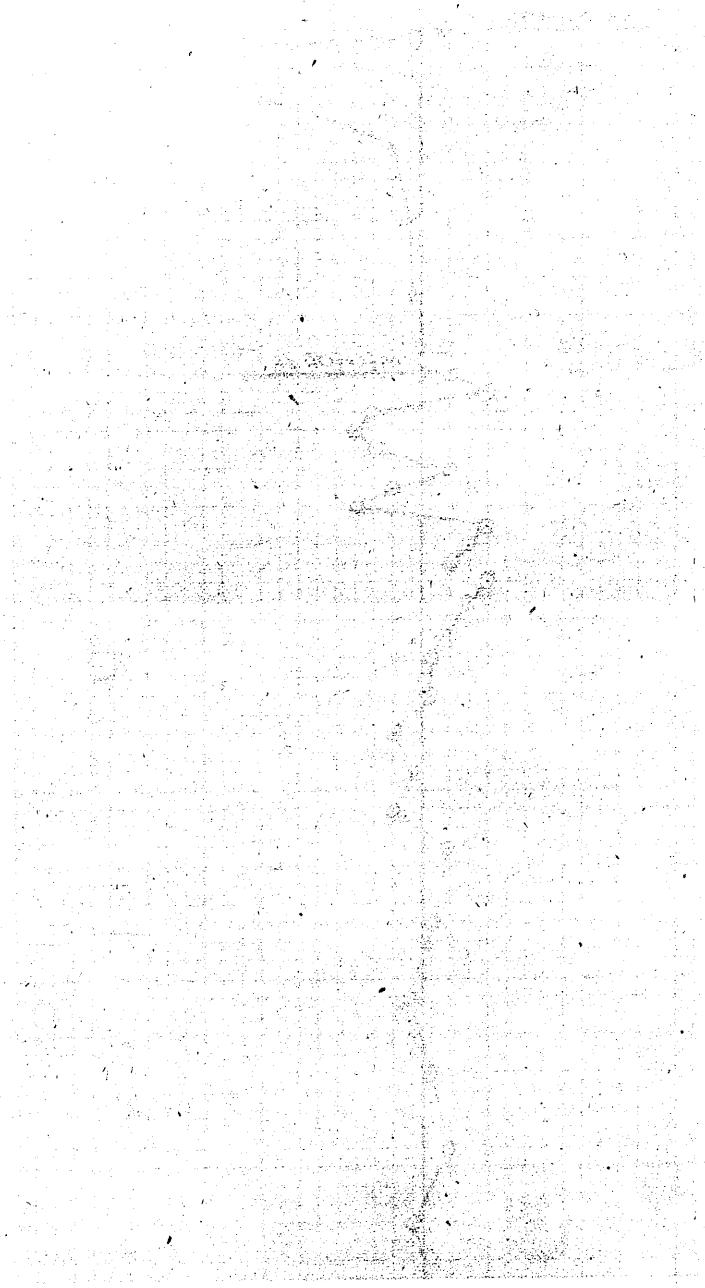

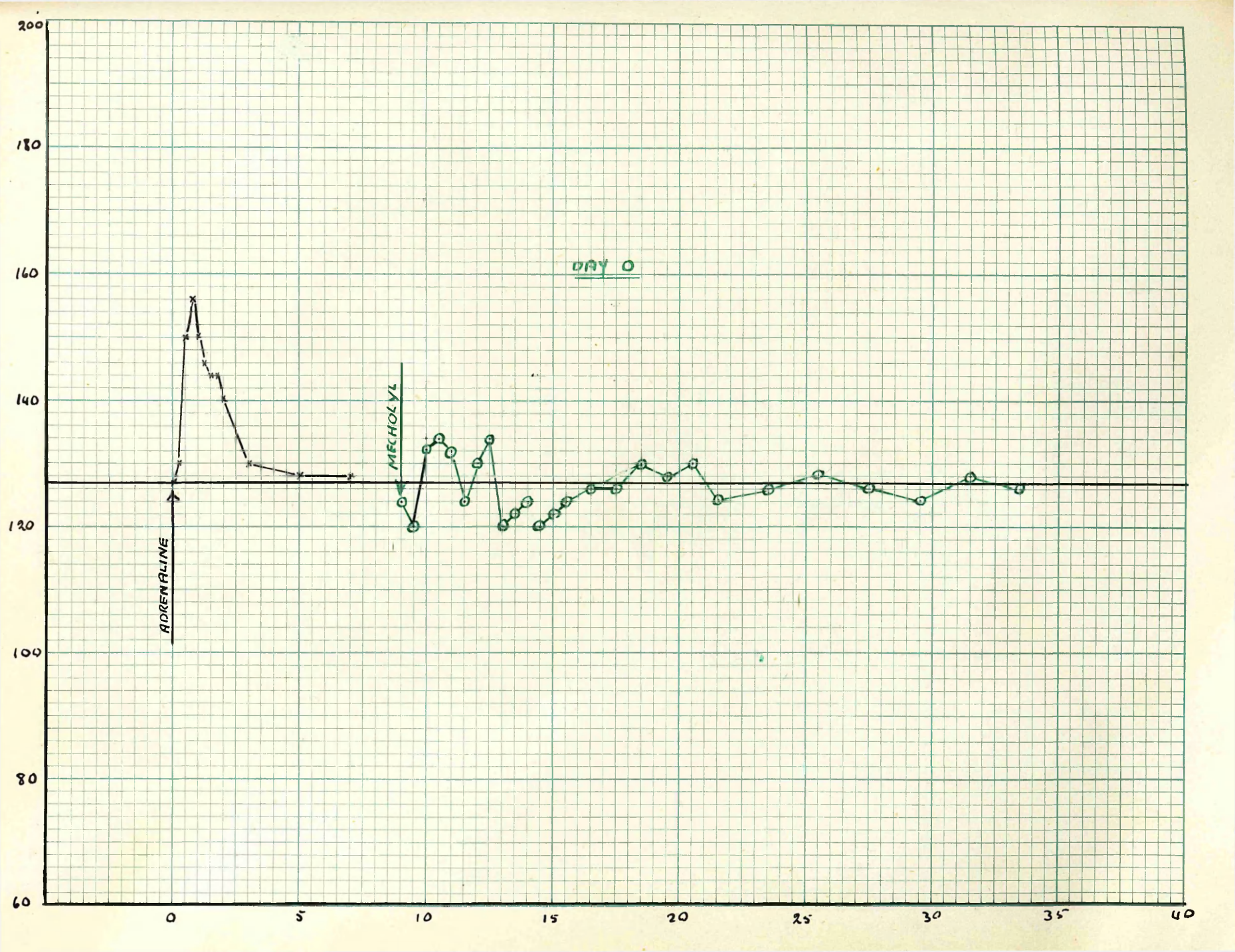
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DAY 0
ADRENALINE
MECHOLYL
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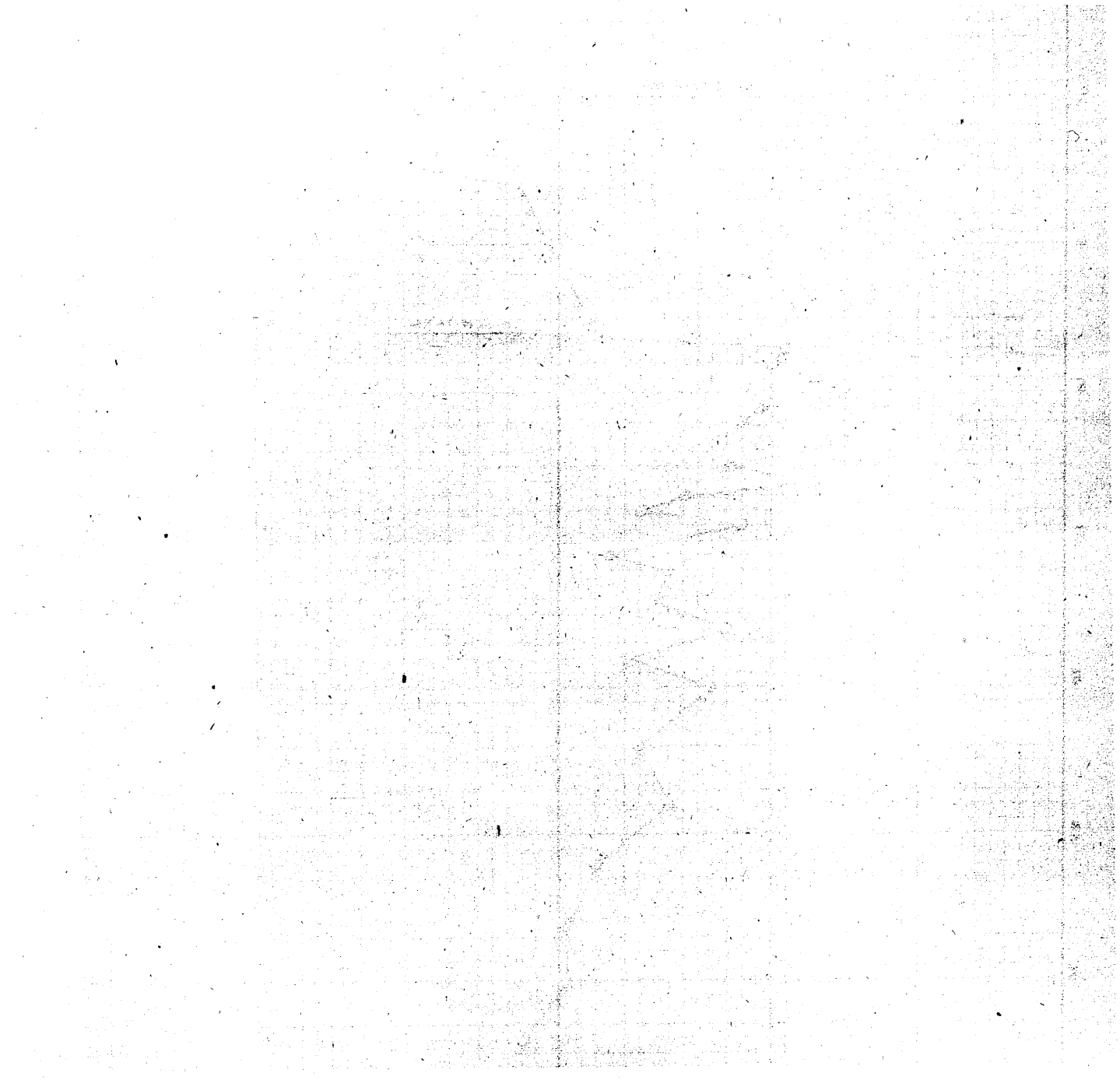
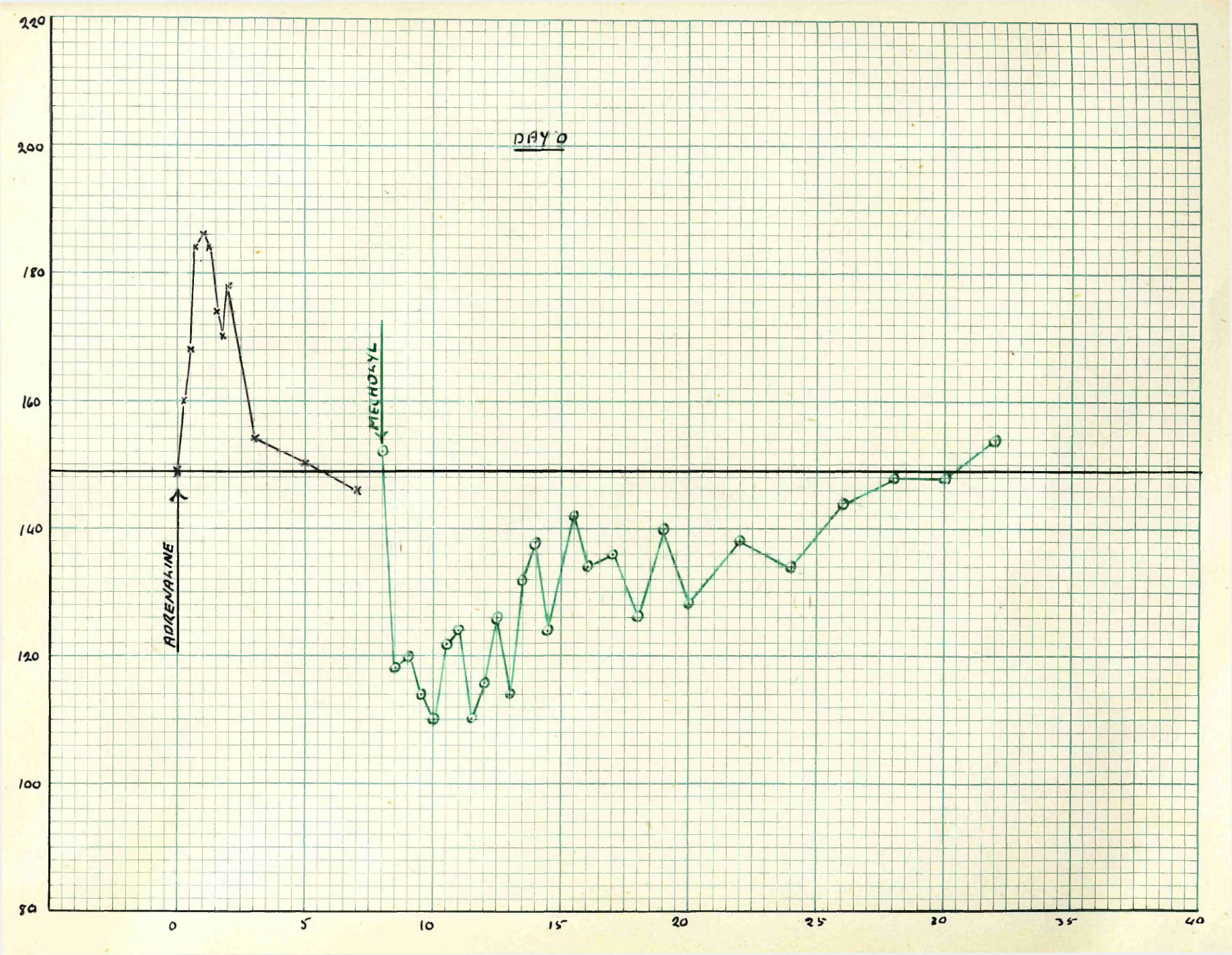
1040 BARASS B.P. DAY 0




DAY 0
ADRENALINE
MECHOLYL
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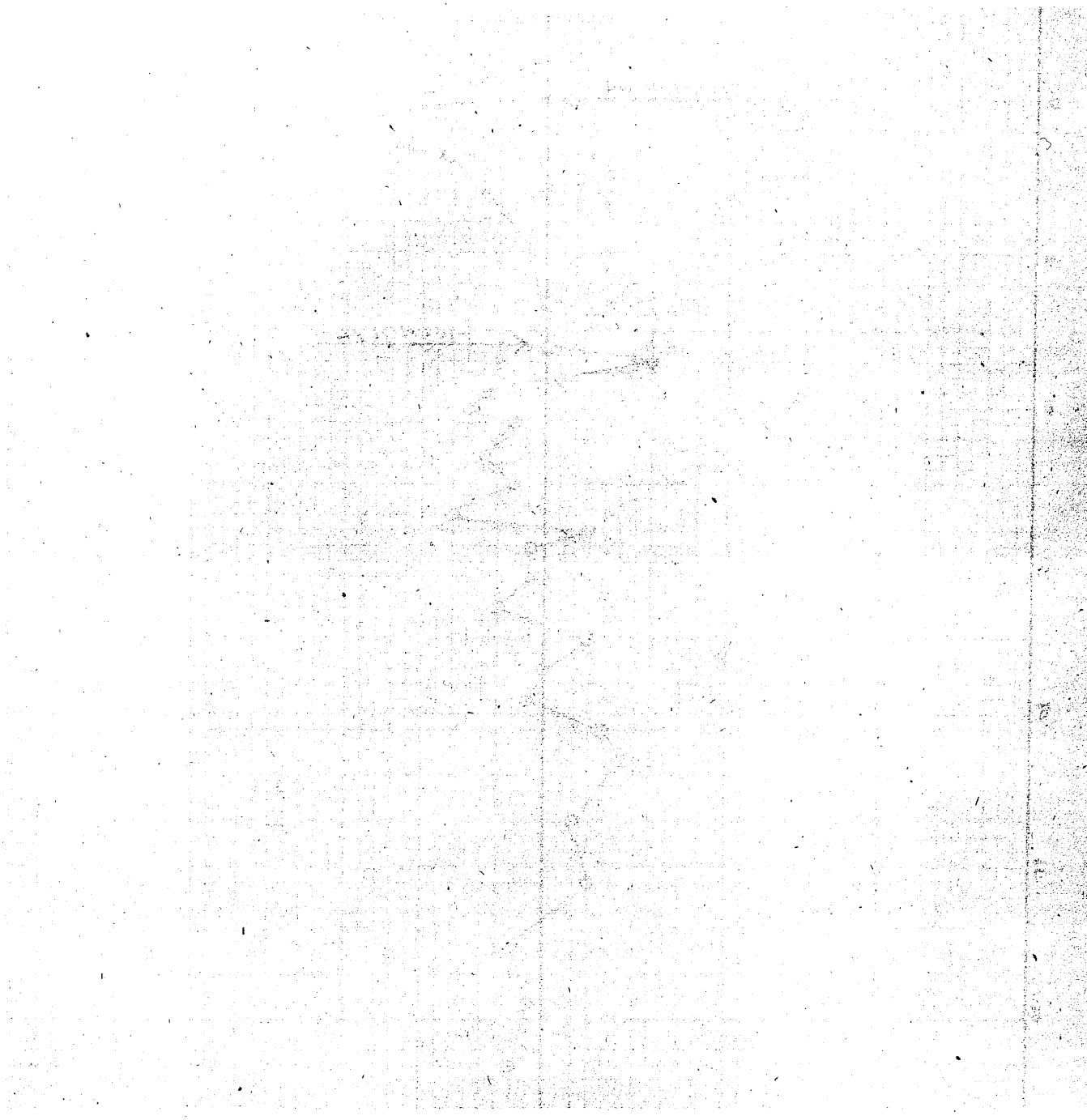
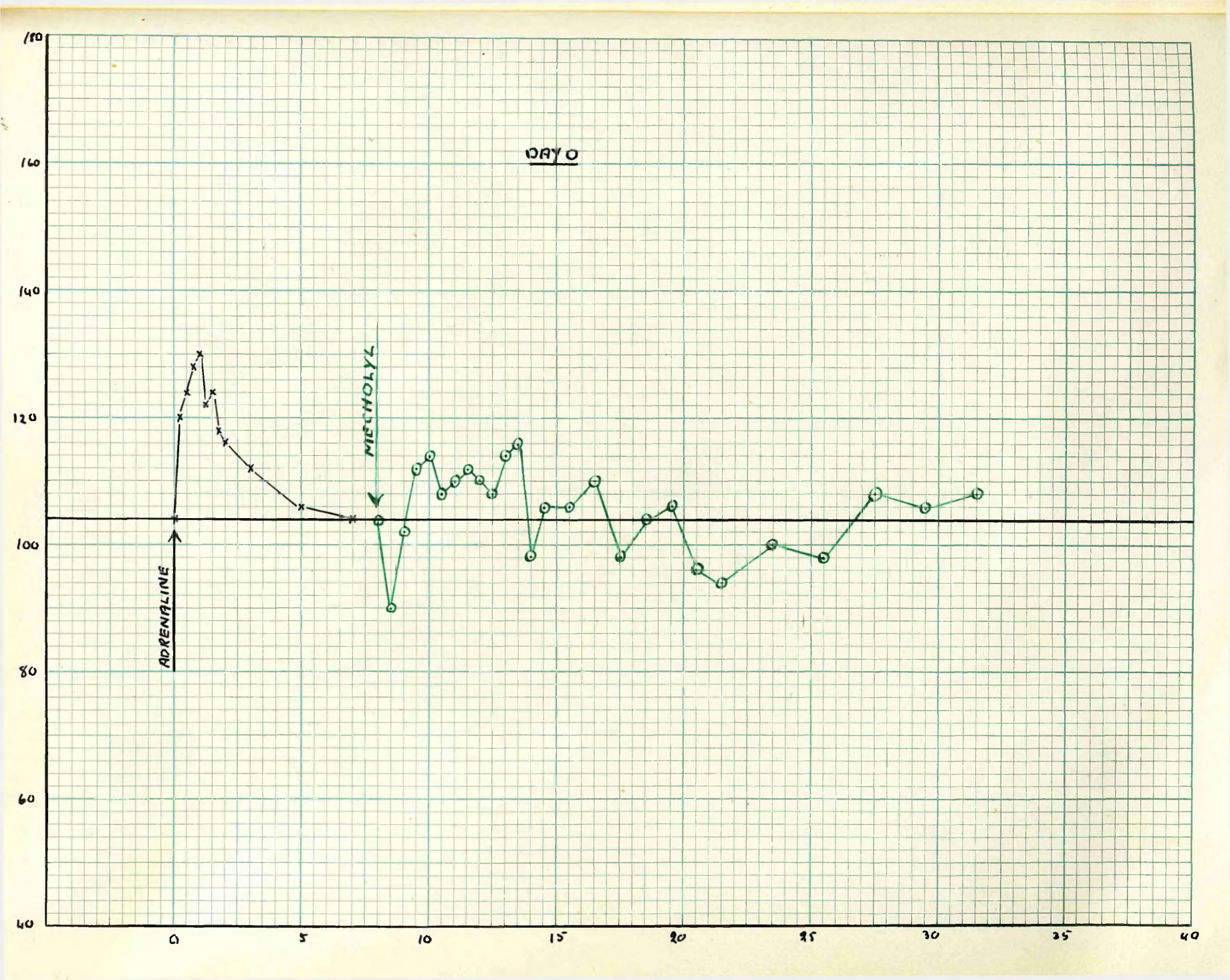
1050 ELLIS I DAY 0




DAY 0
ADRENALINE
MECHOLYL
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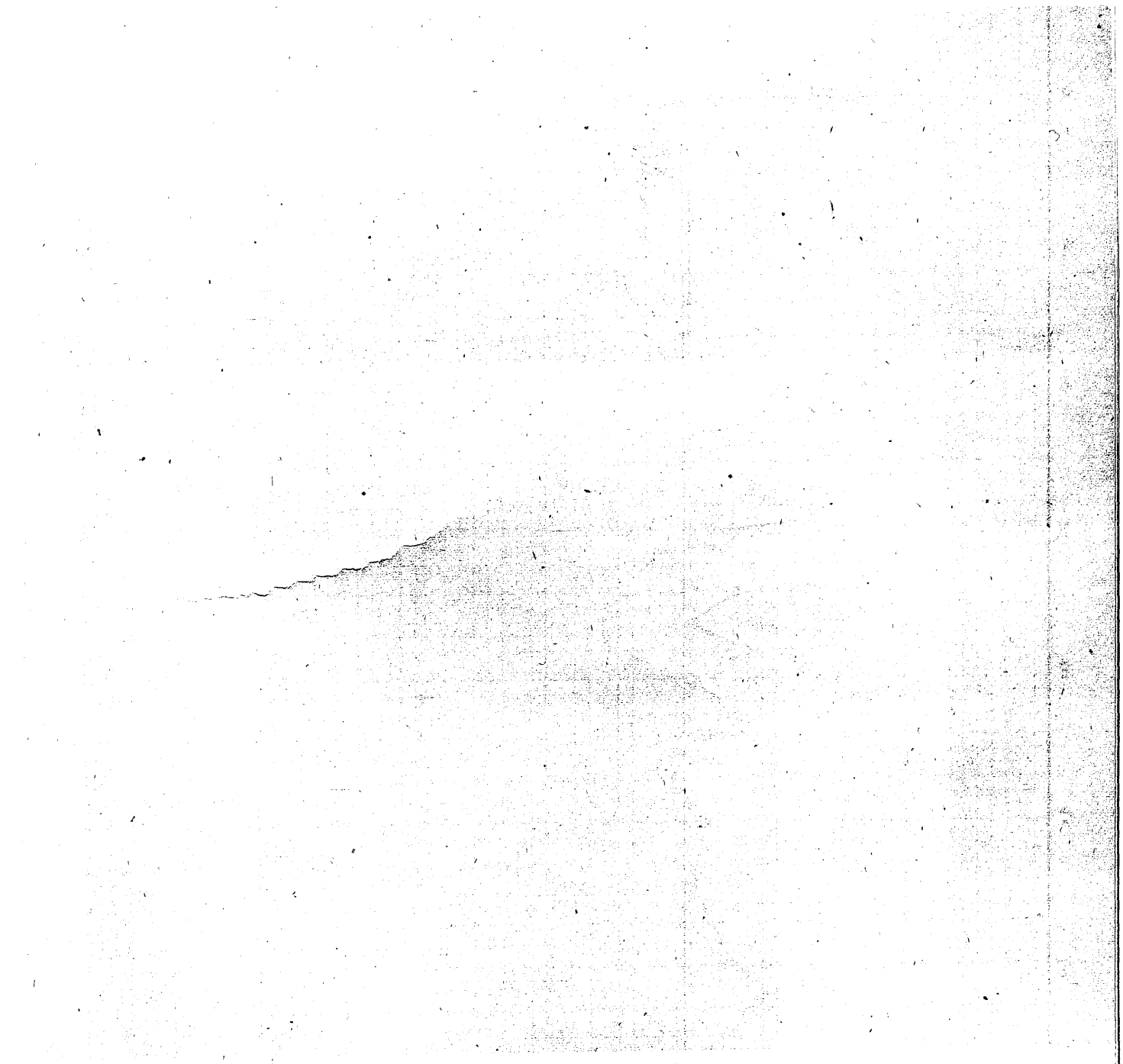
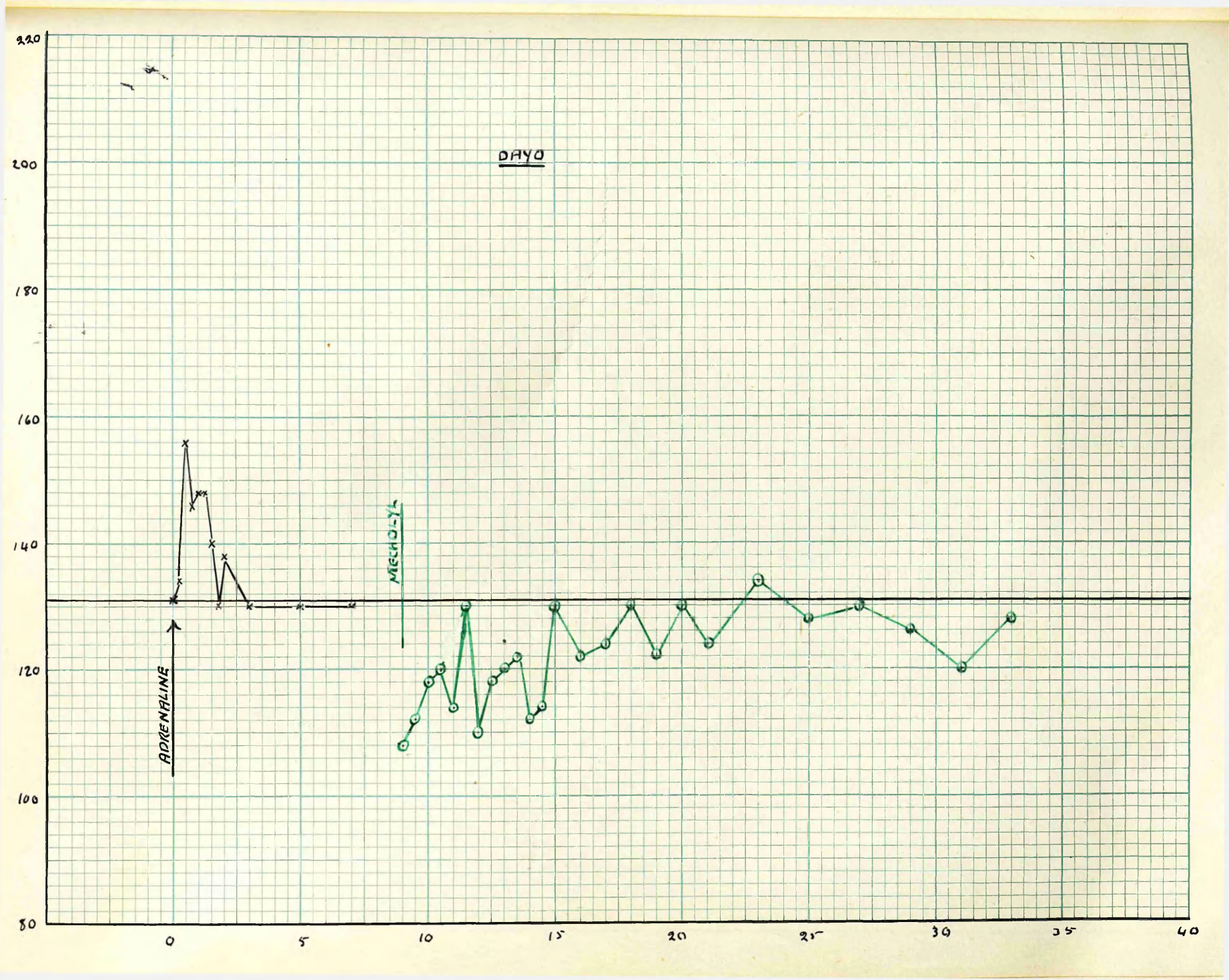
1960 BOWLES GC BAY D

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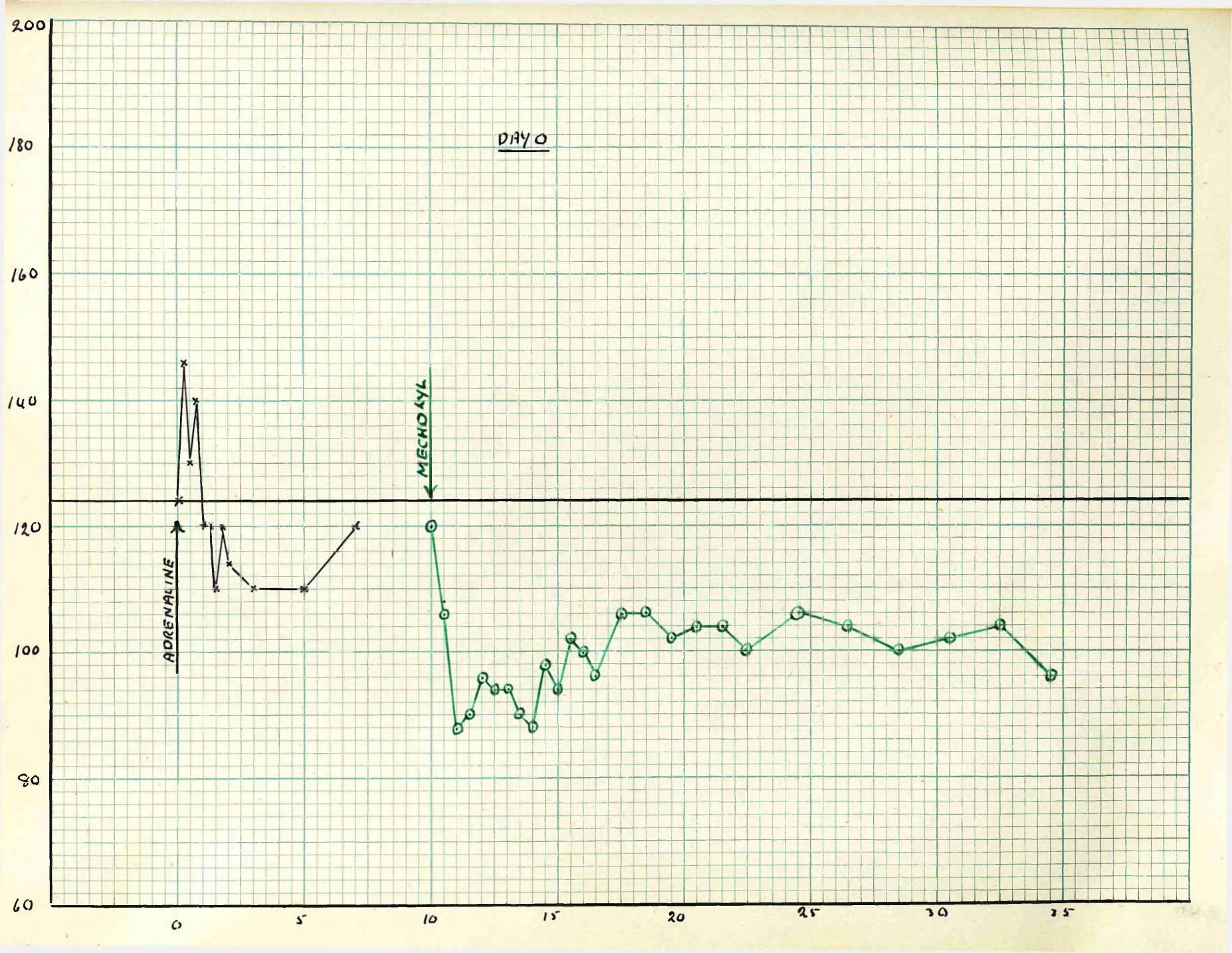
DAY 0
ADRENALINE
MECHOLYL

1070 BLAKEY C DAY 9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DAY 0
MECHOLYL
ADRENALINE
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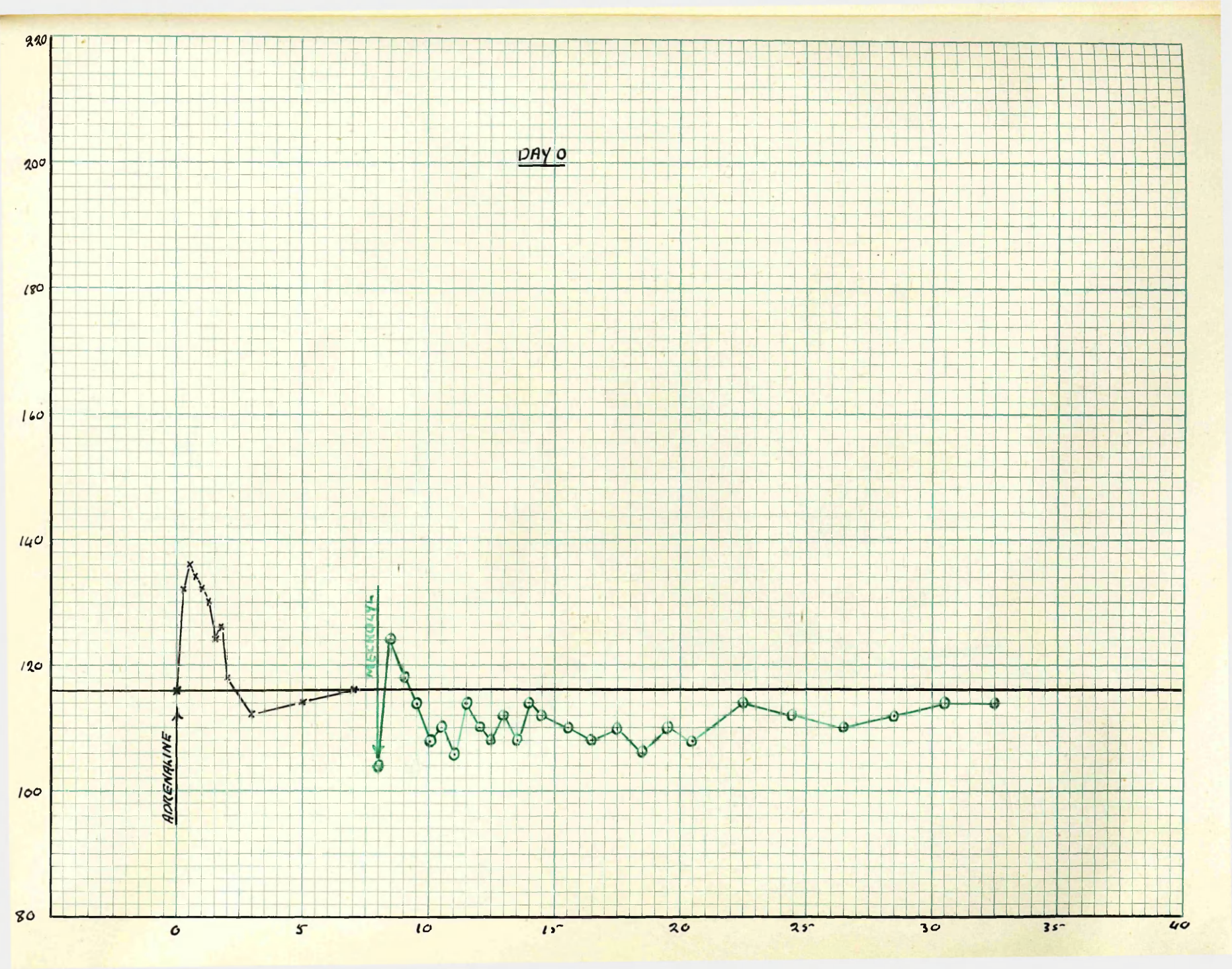
1080 BACON HA DAY 0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DAY 0
ADRENALINE
MESCOLYL
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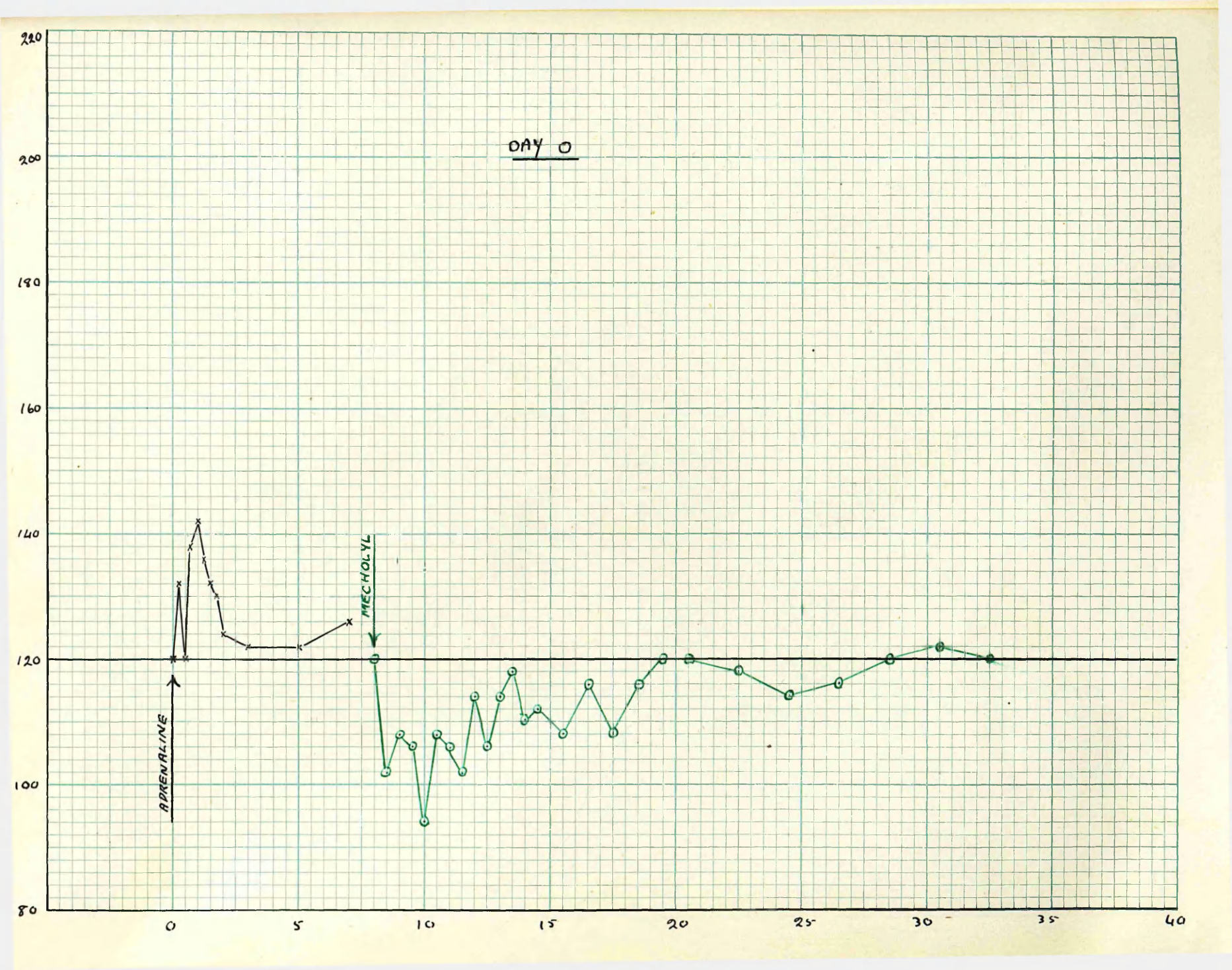
DAY 0
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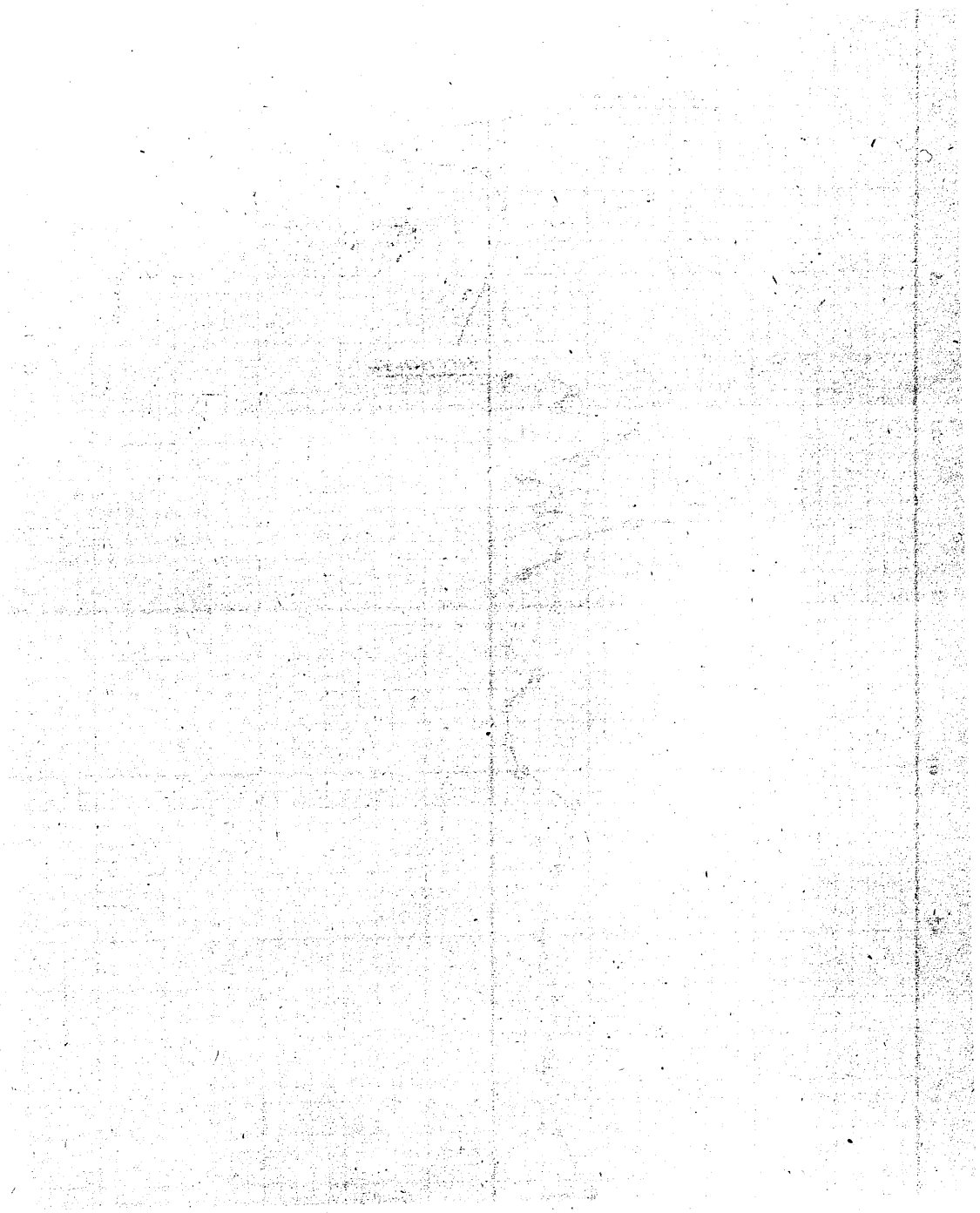
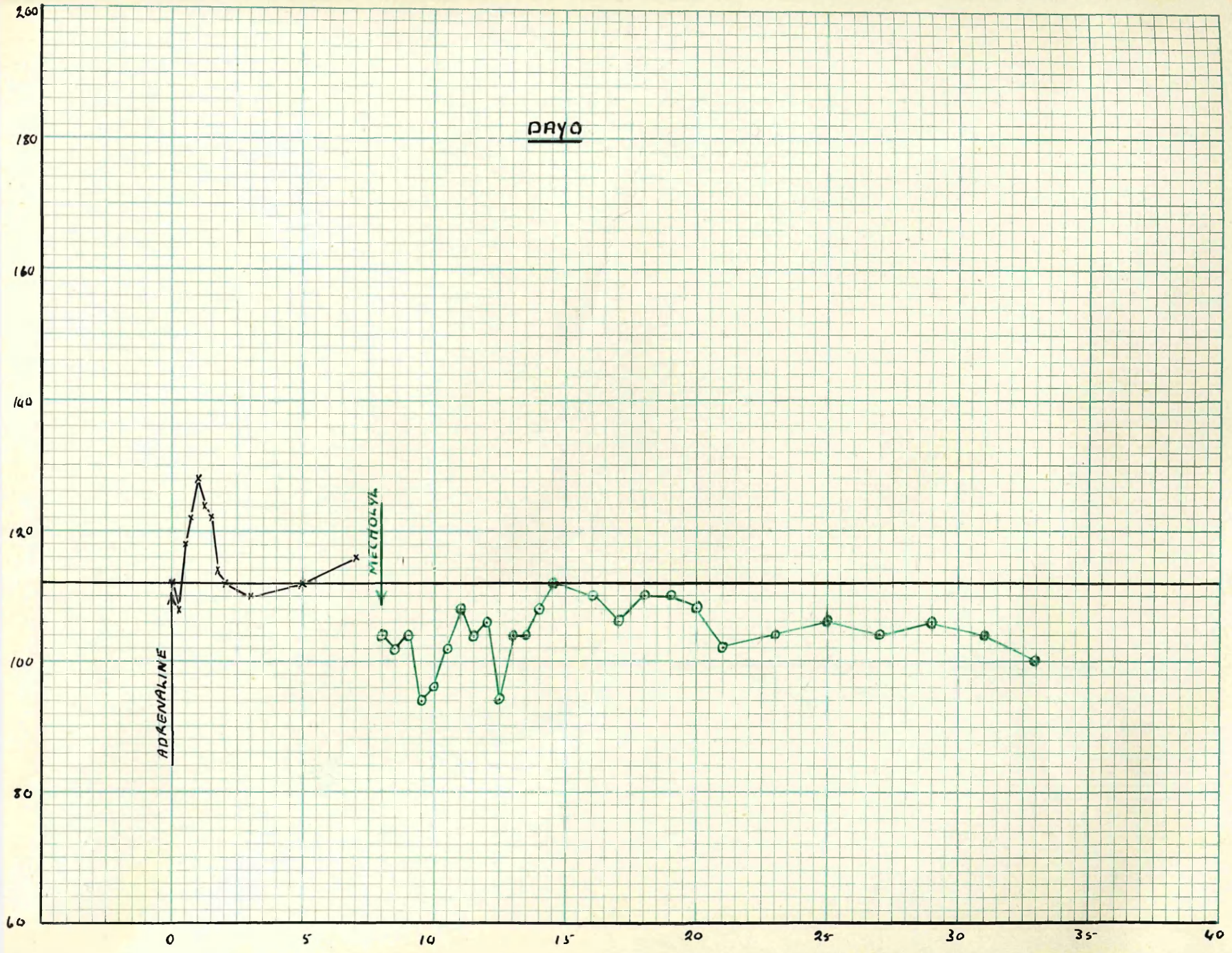
ADRENALINE
MECHOLYL

1100 RENNISON F DAY 0

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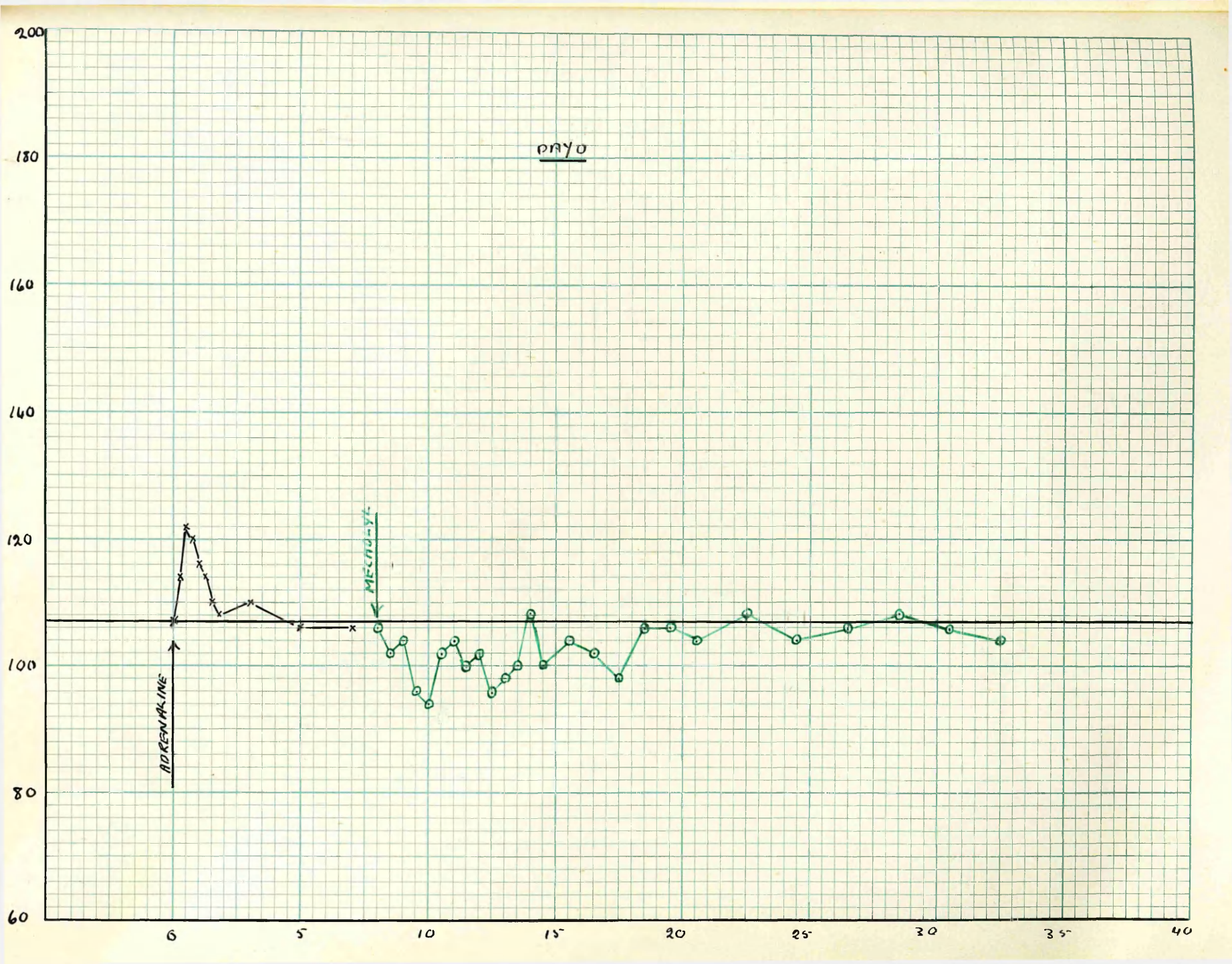
ADRENALINE
MECHOLYL

1110 W LEEK DAY 0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PAYO
ADRENALINE
MECHONYL
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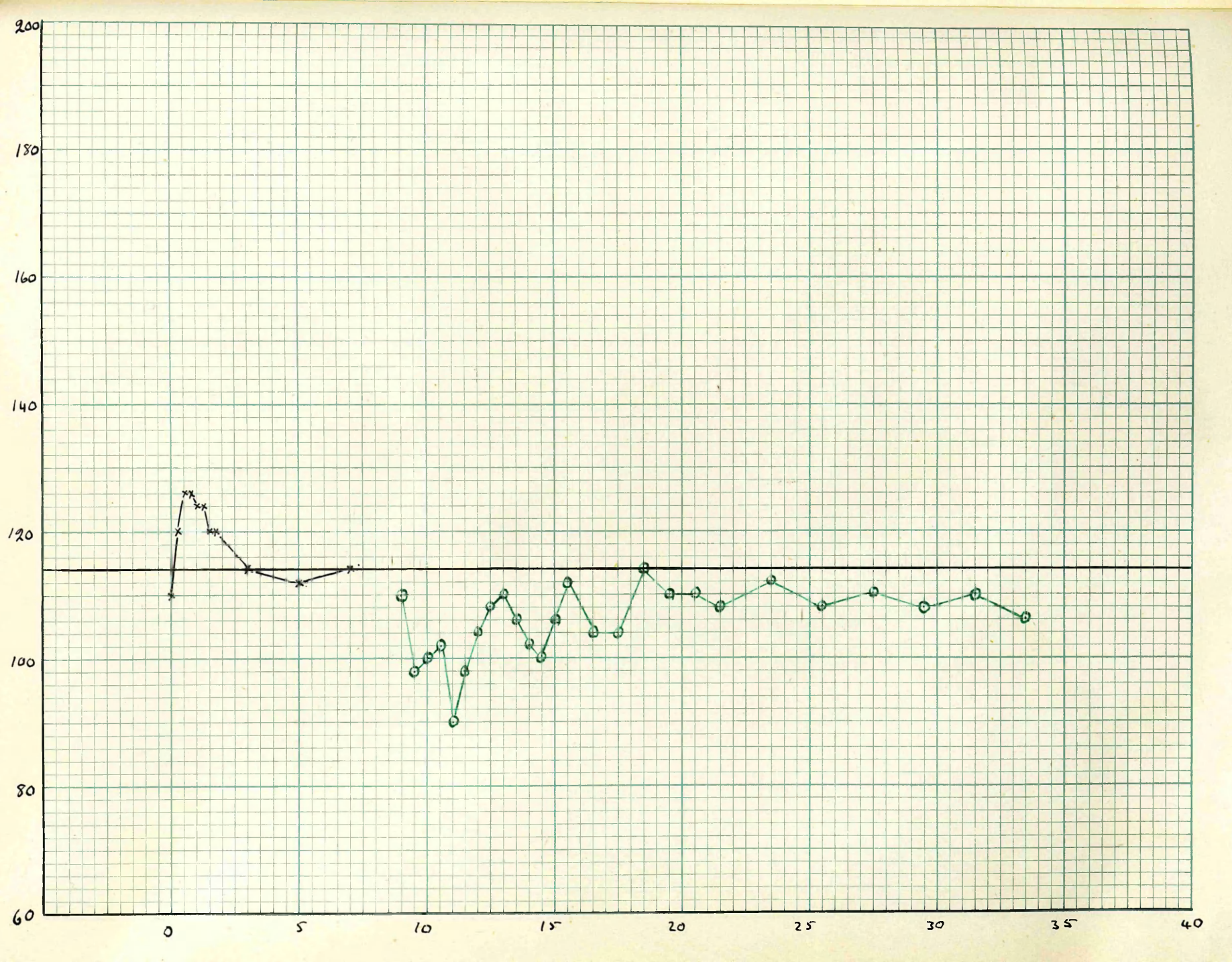
1120 HYNES O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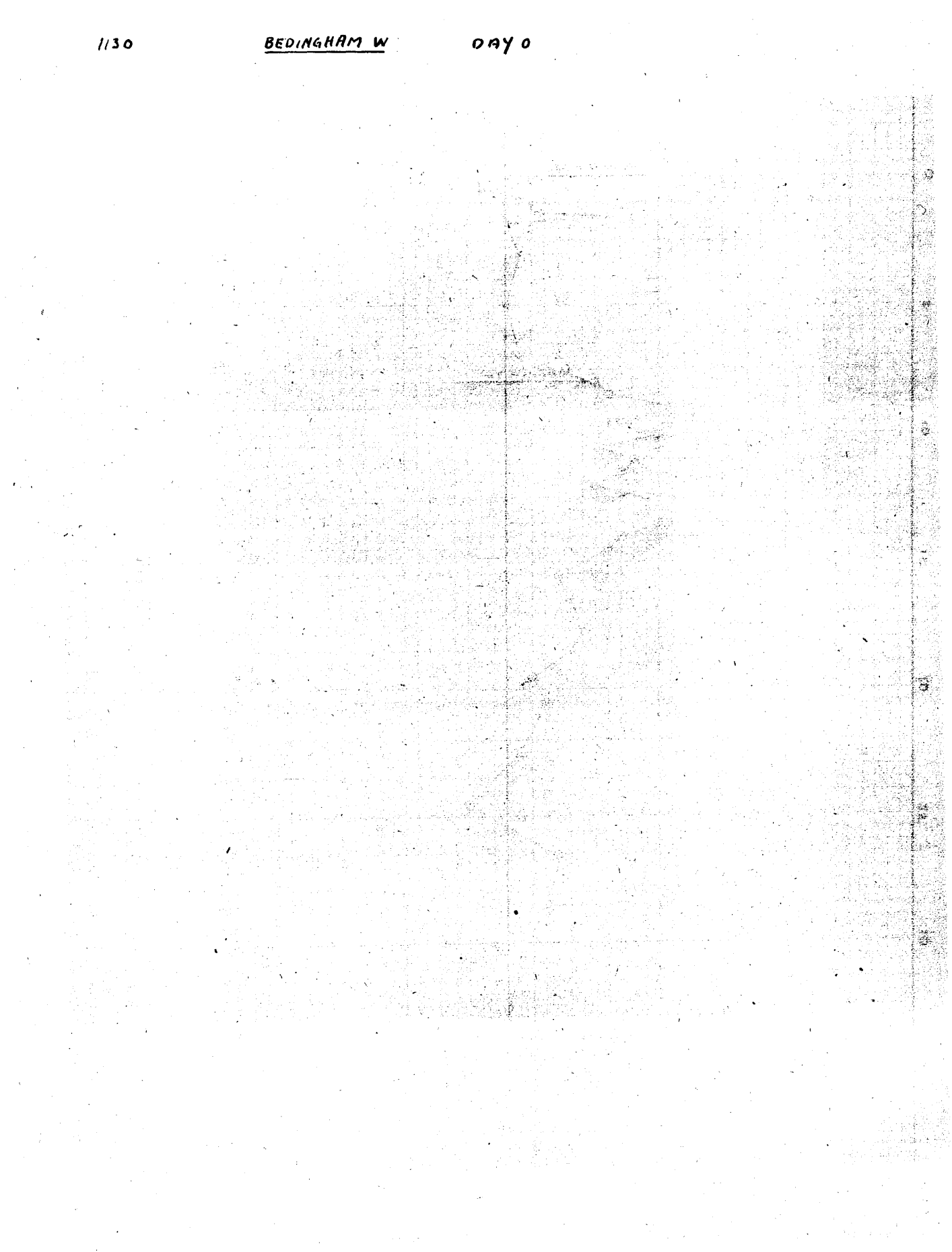

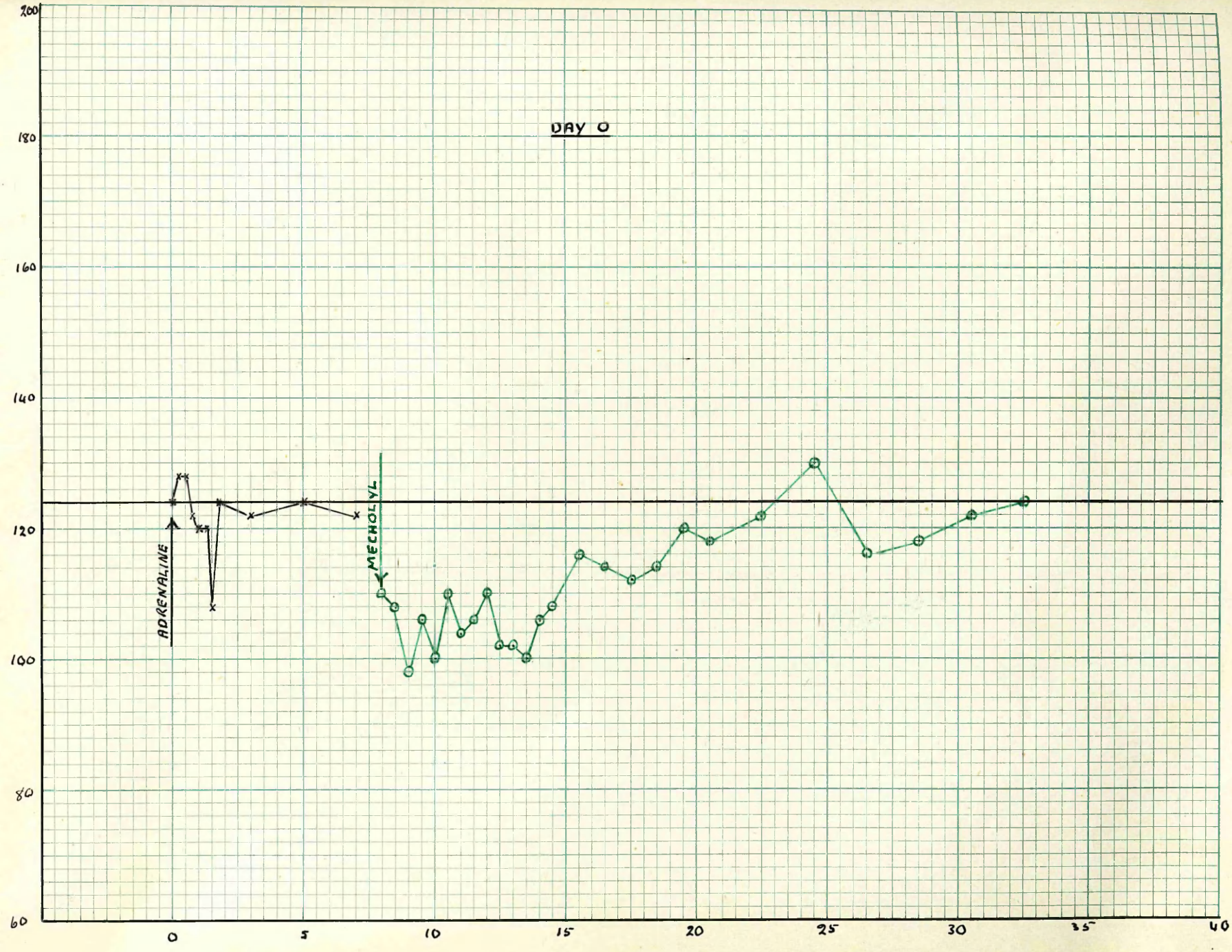
DAY 0
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ADRENALINE
MECHOLYL
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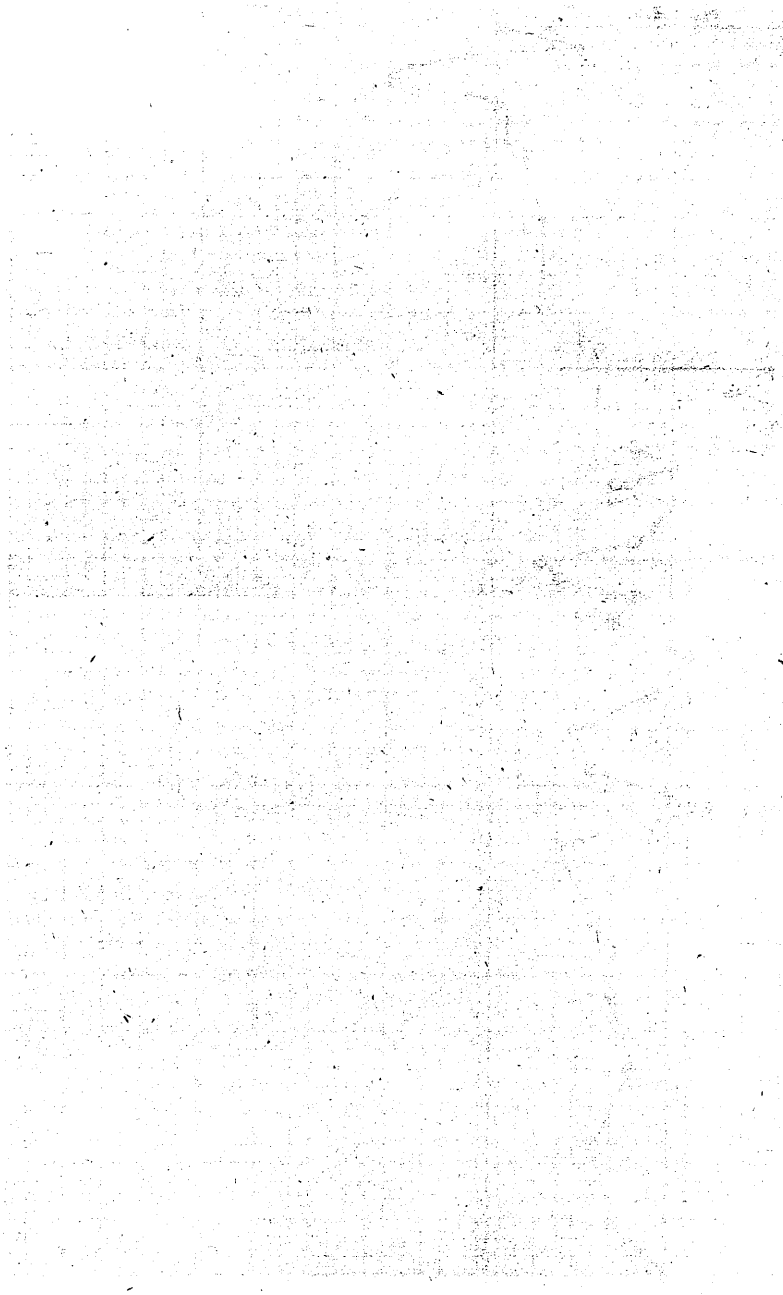
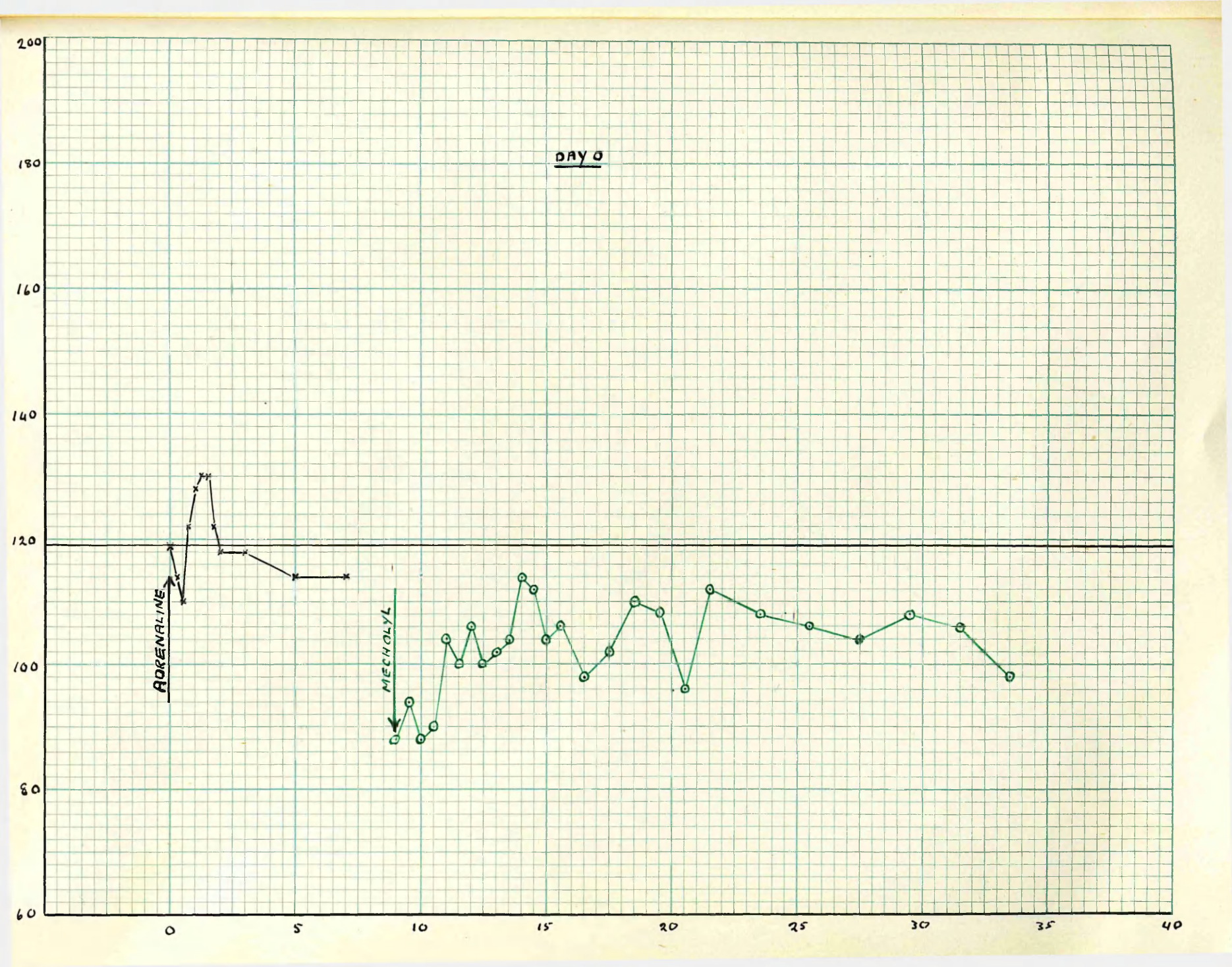
1140 BURN CG DAY 0

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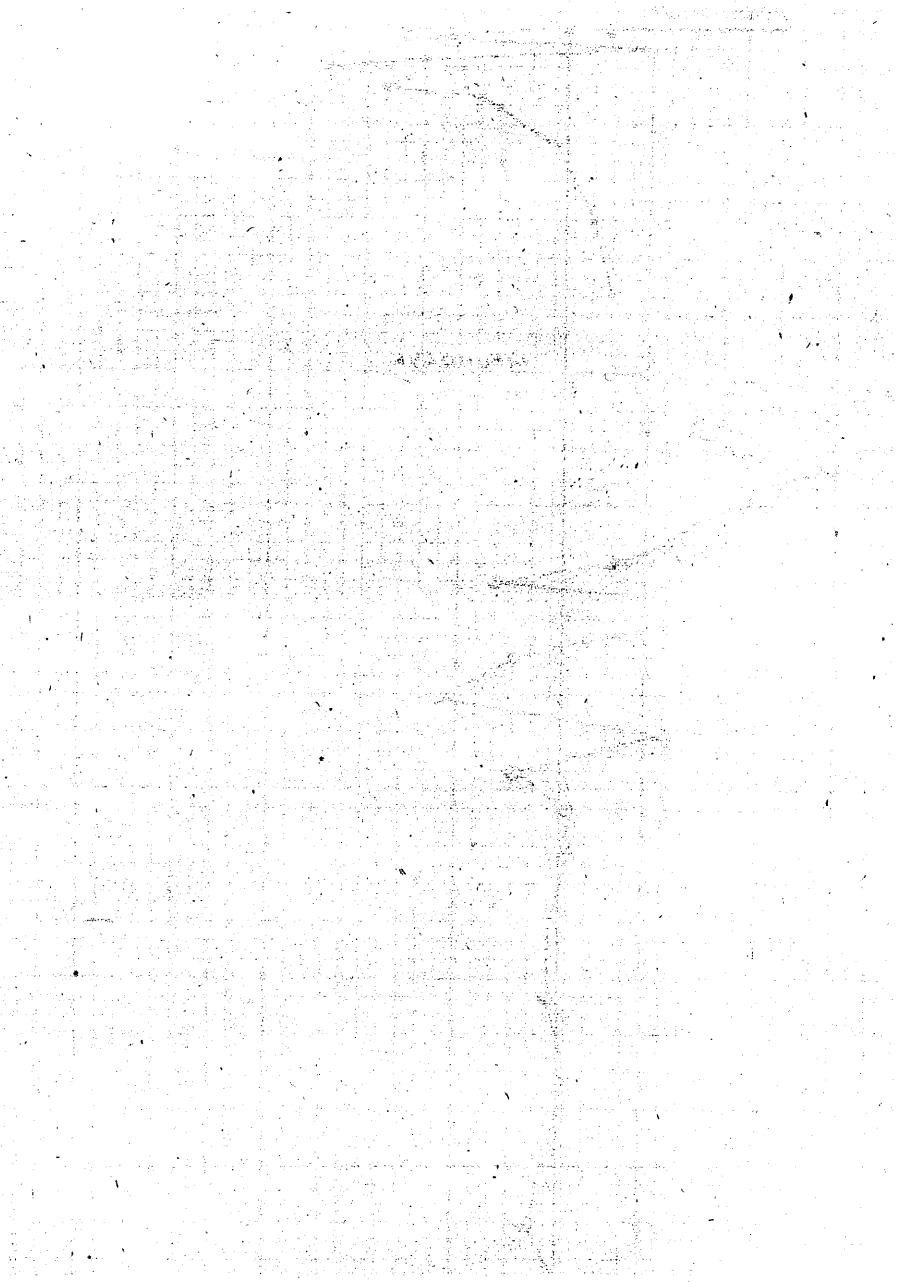
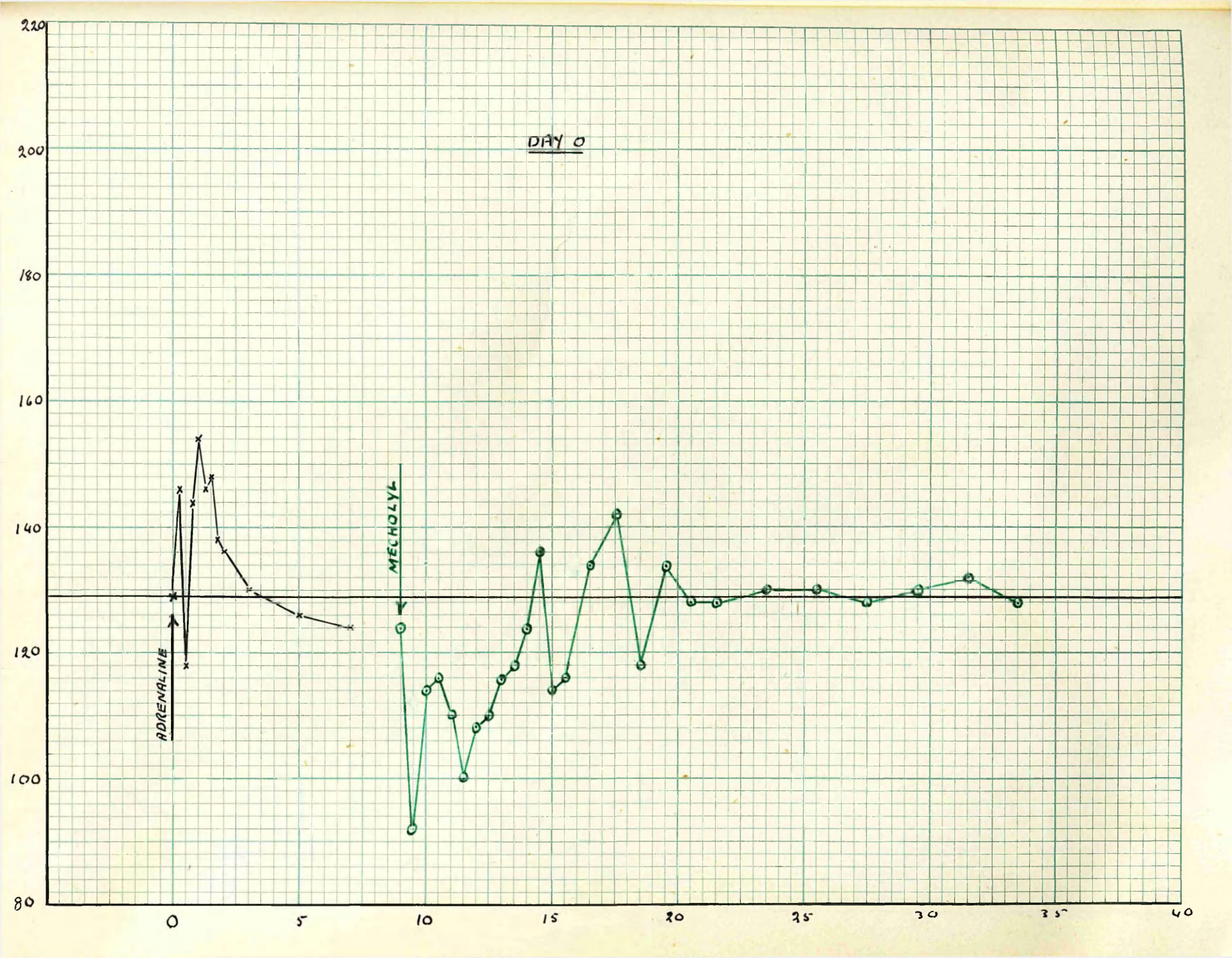
ADRENALINE
MECHOLYL

1150 MORE GL DAYO

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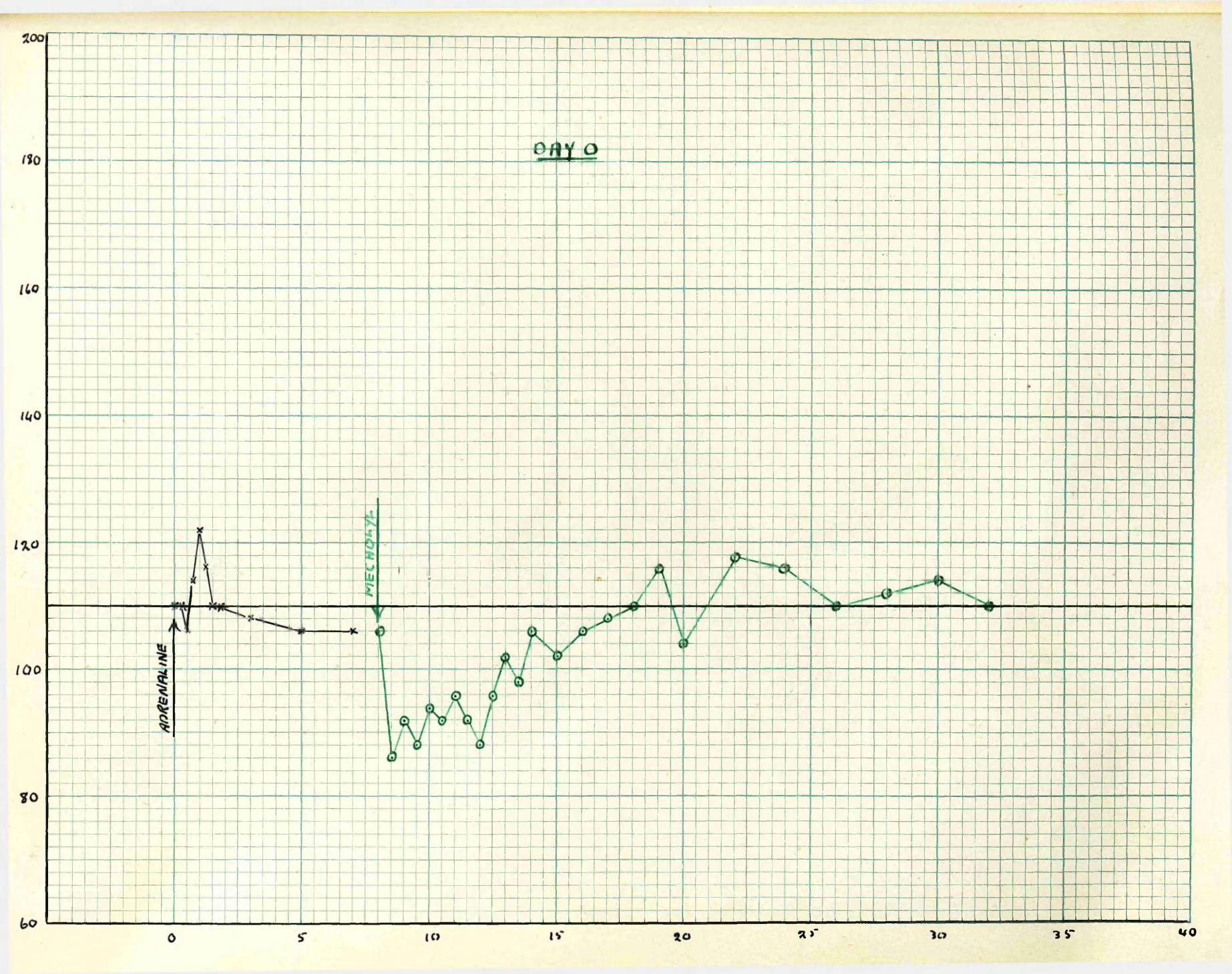
ADRENALINE
MECHOLYL

LIMBO DAYO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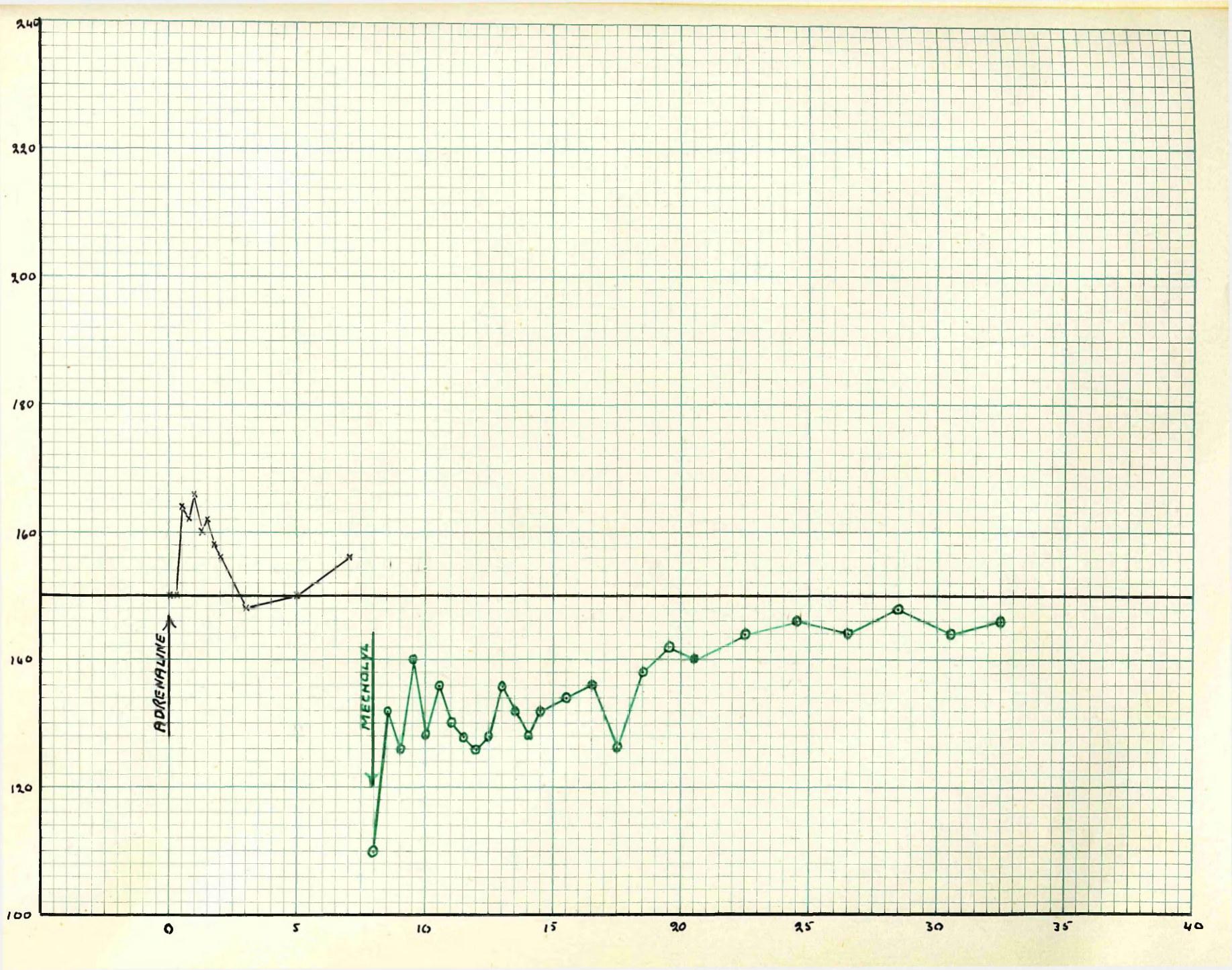
1170 PEAKE R DAY O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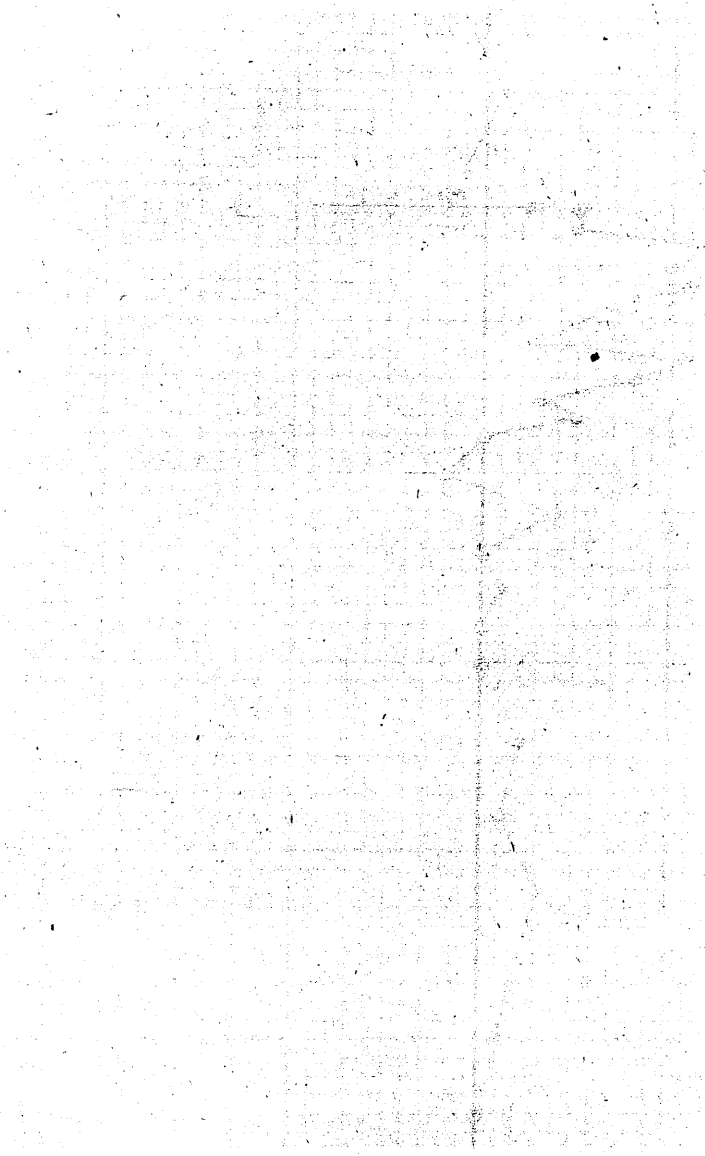
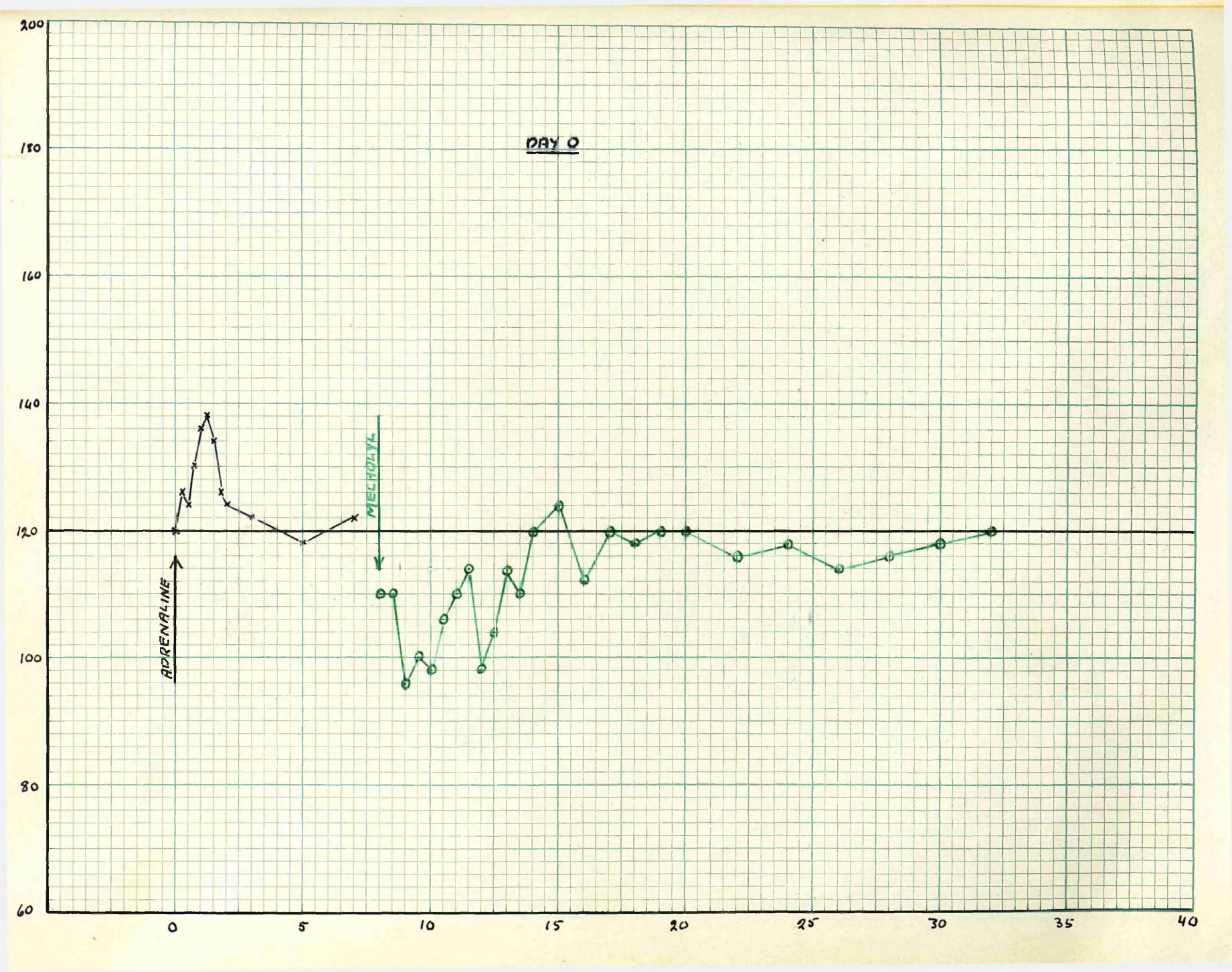
ADRENALINE
MECHOLYL

1180 MITCHELL KE DAY 0

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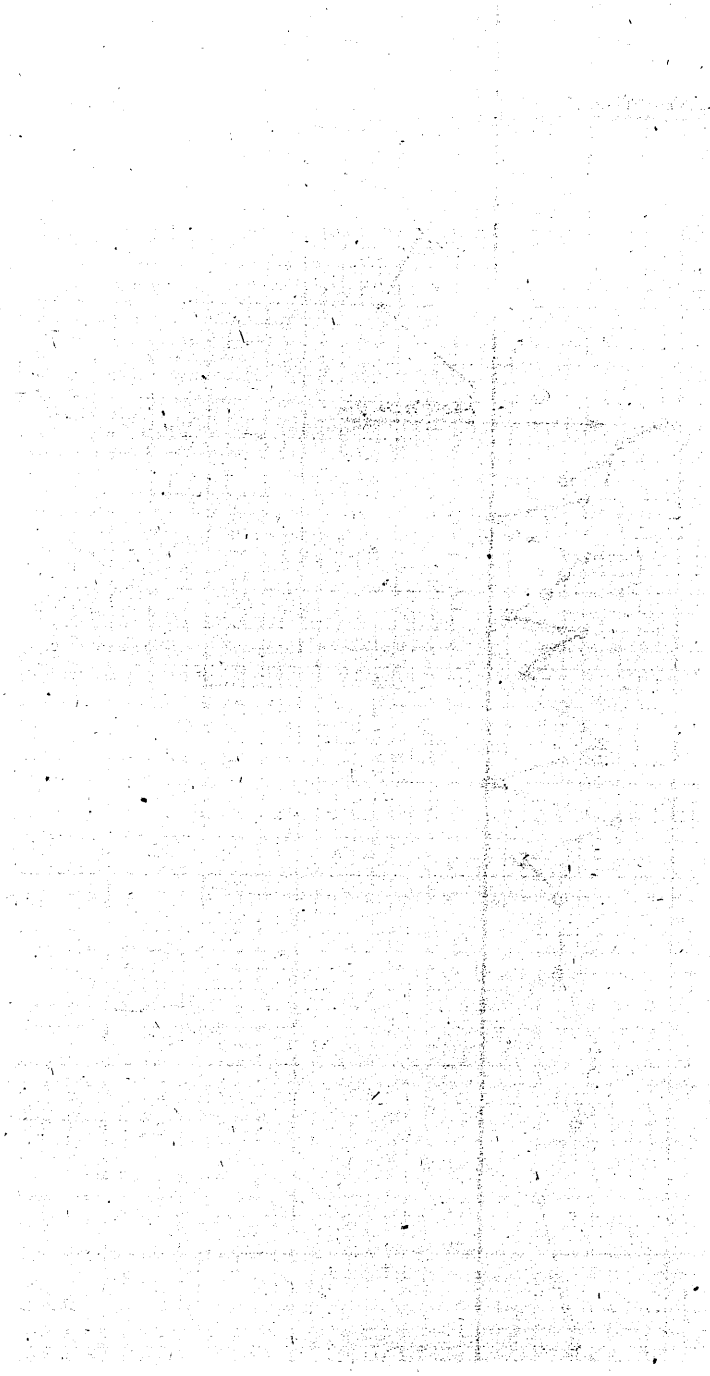

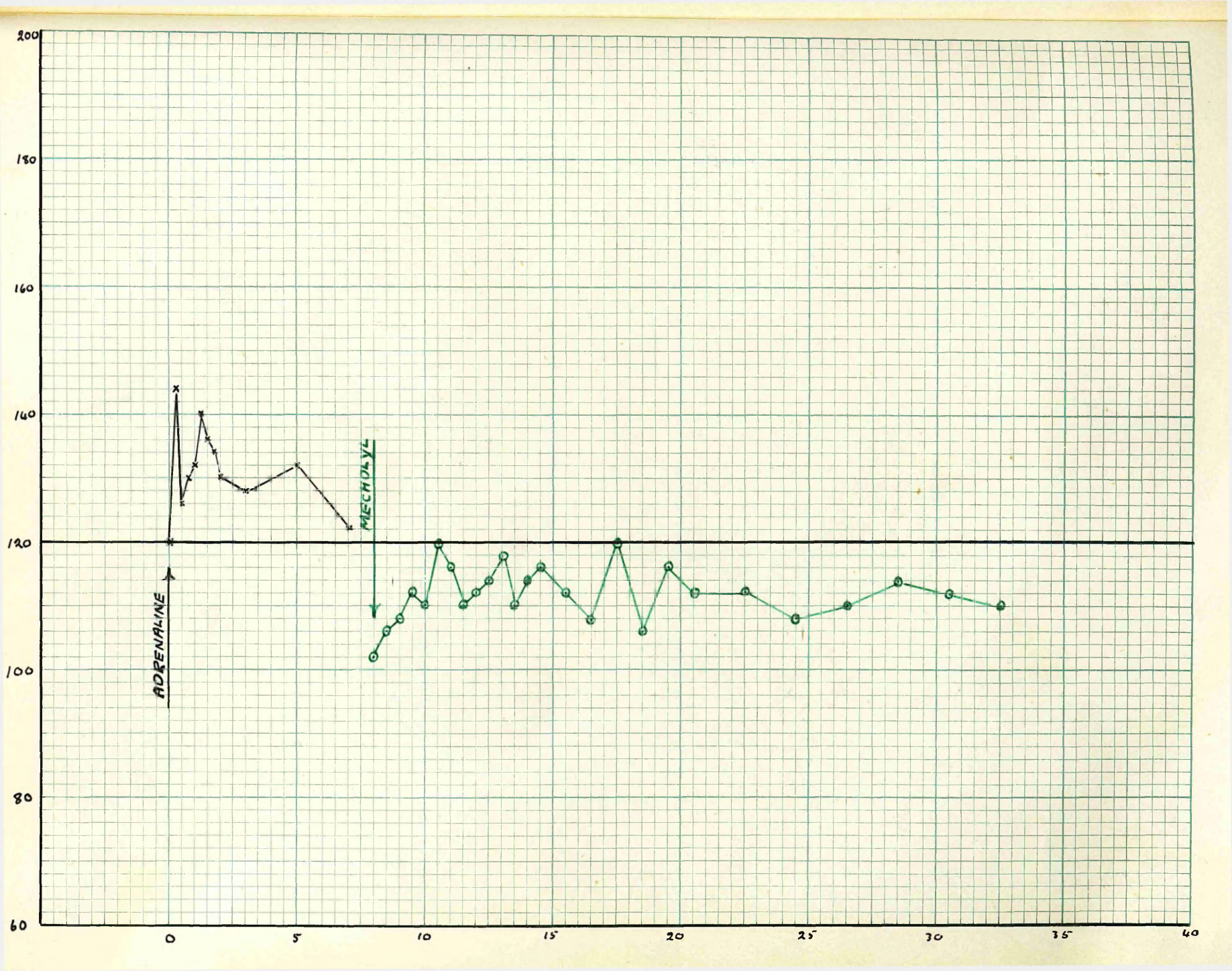
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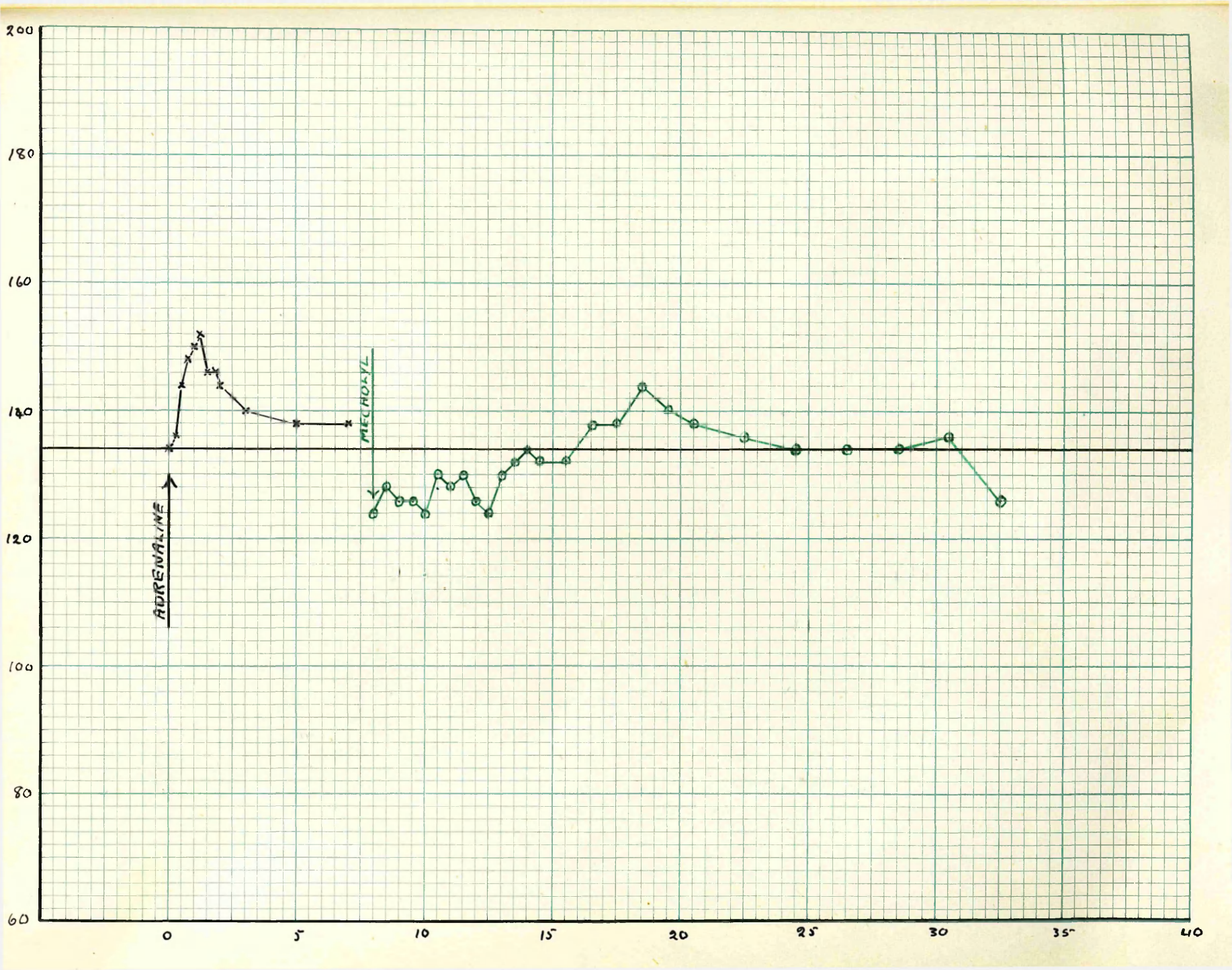
1200 WILSON L DAYO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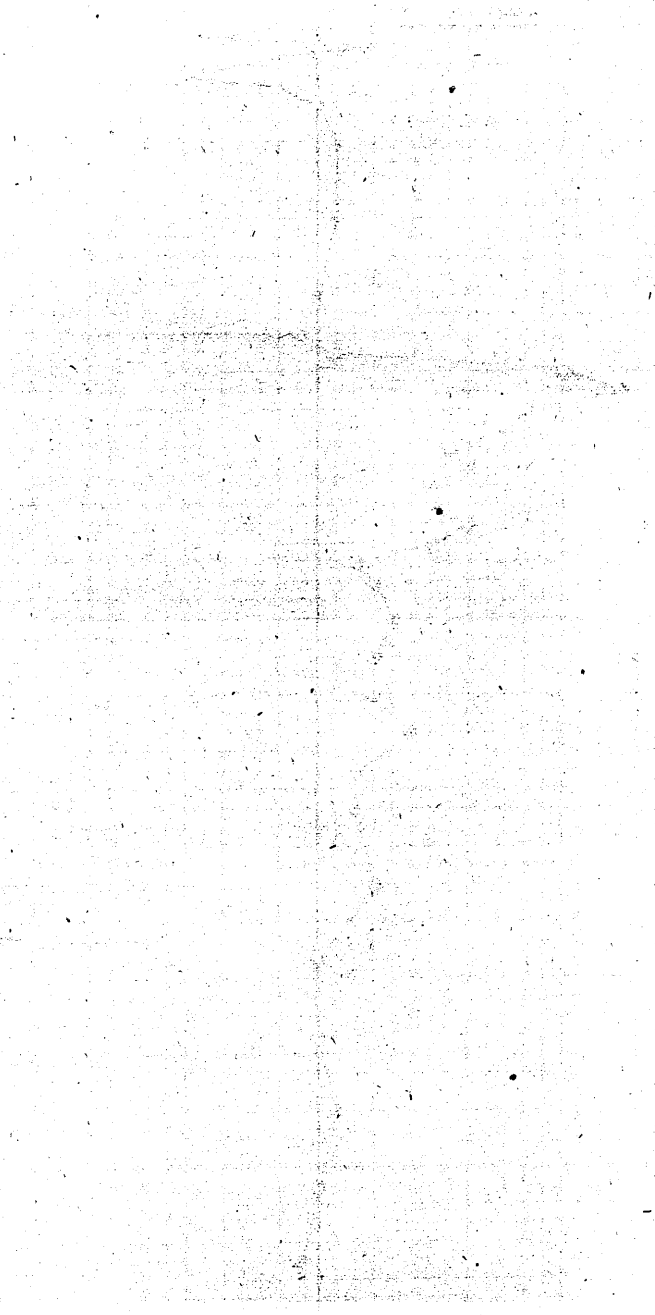
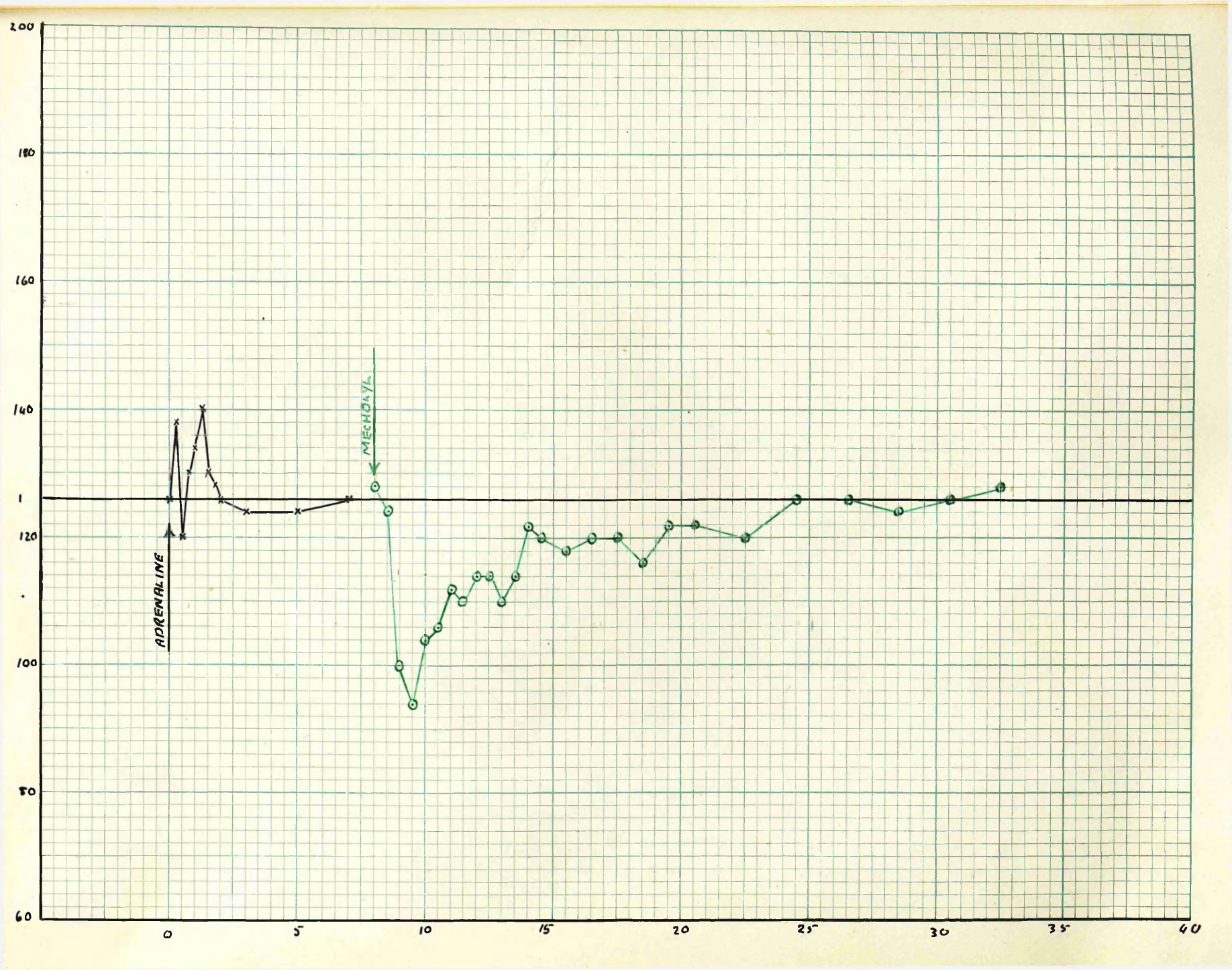
1210 GALLAGHER J T DAY 0

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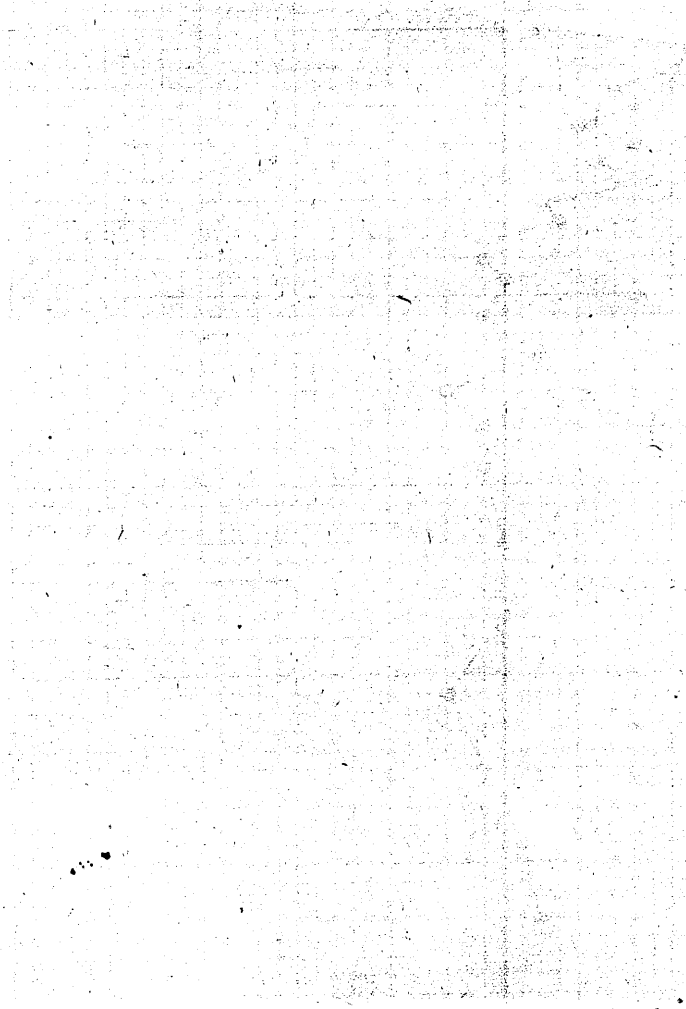

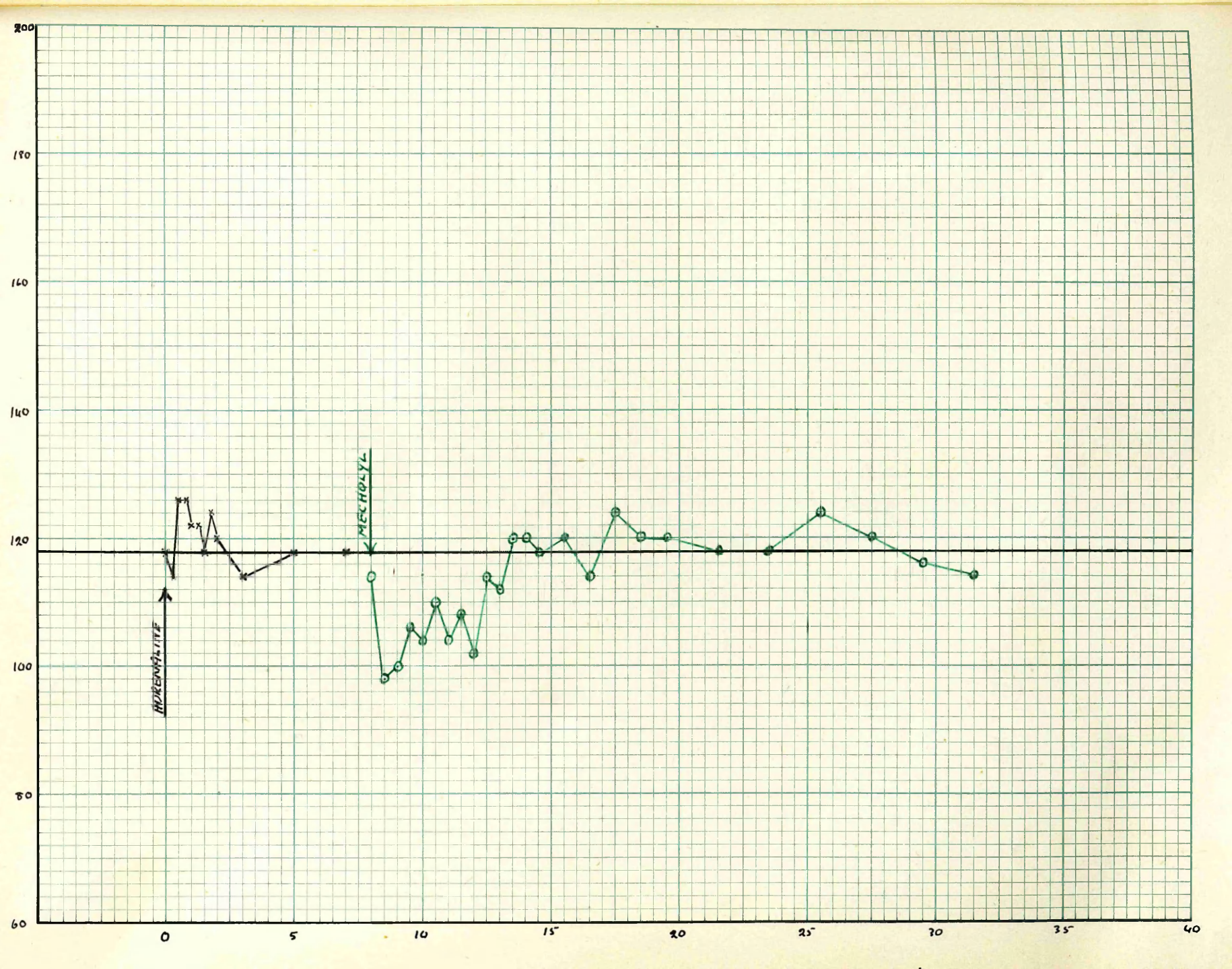
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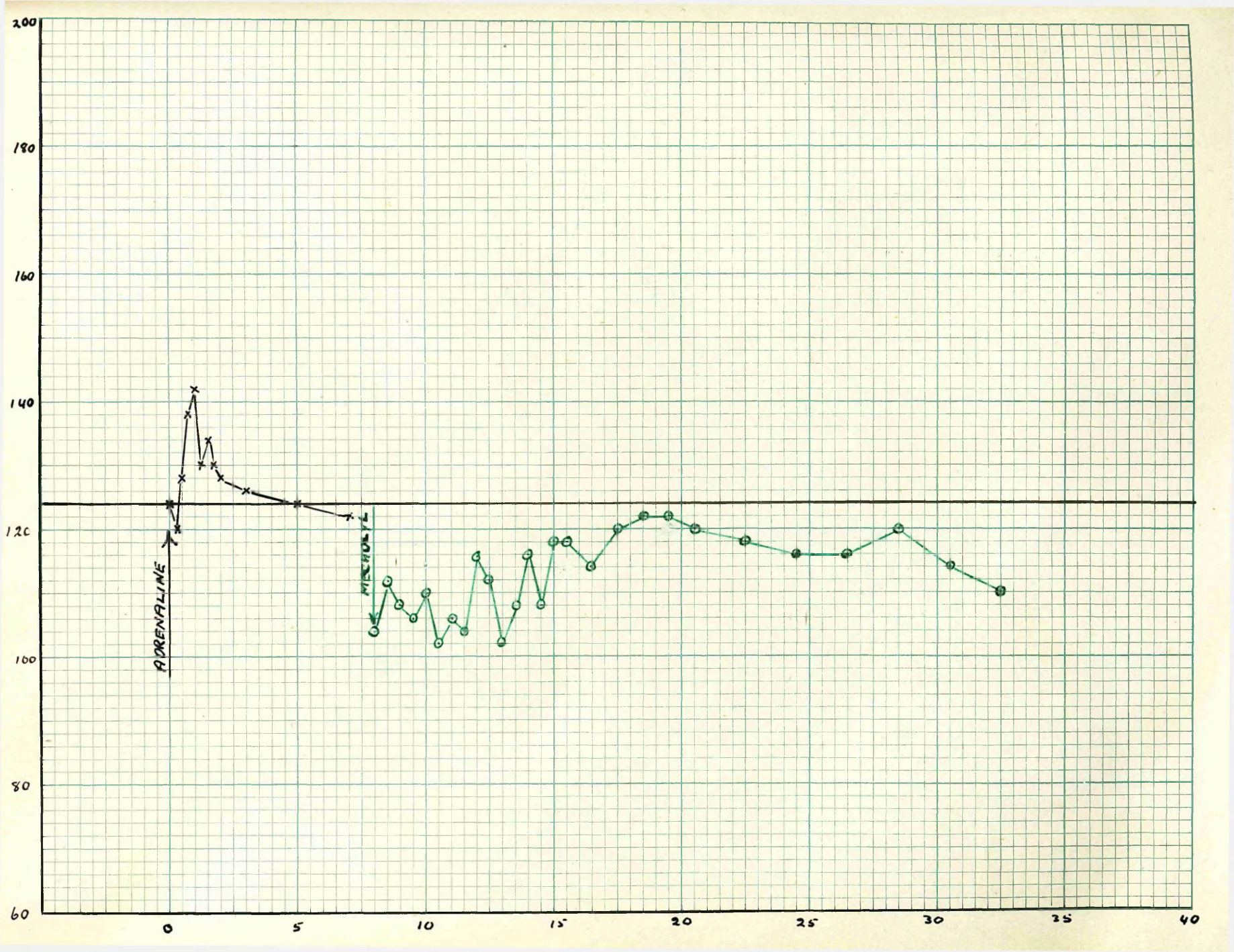
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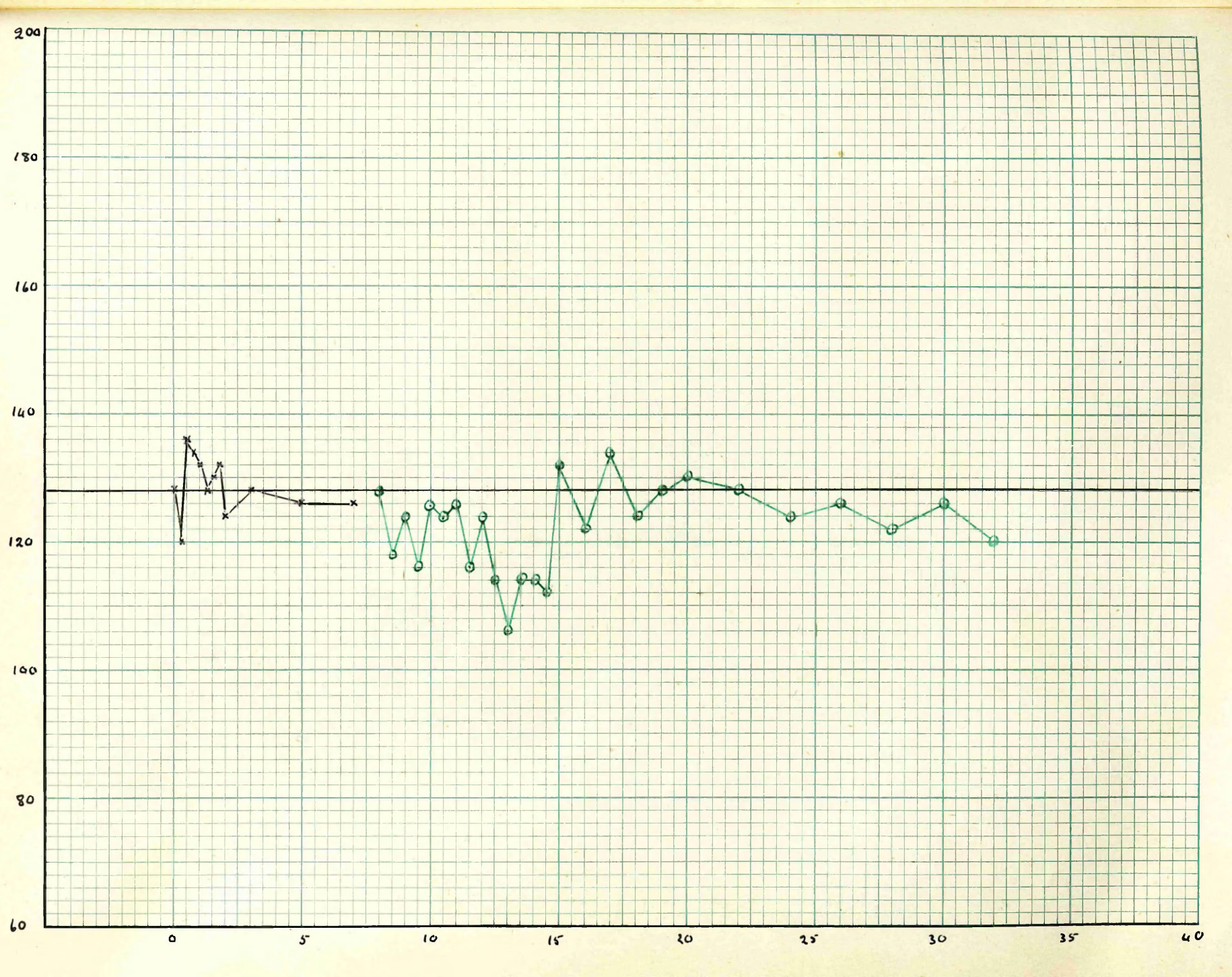
1240 ANDREWS R DAY O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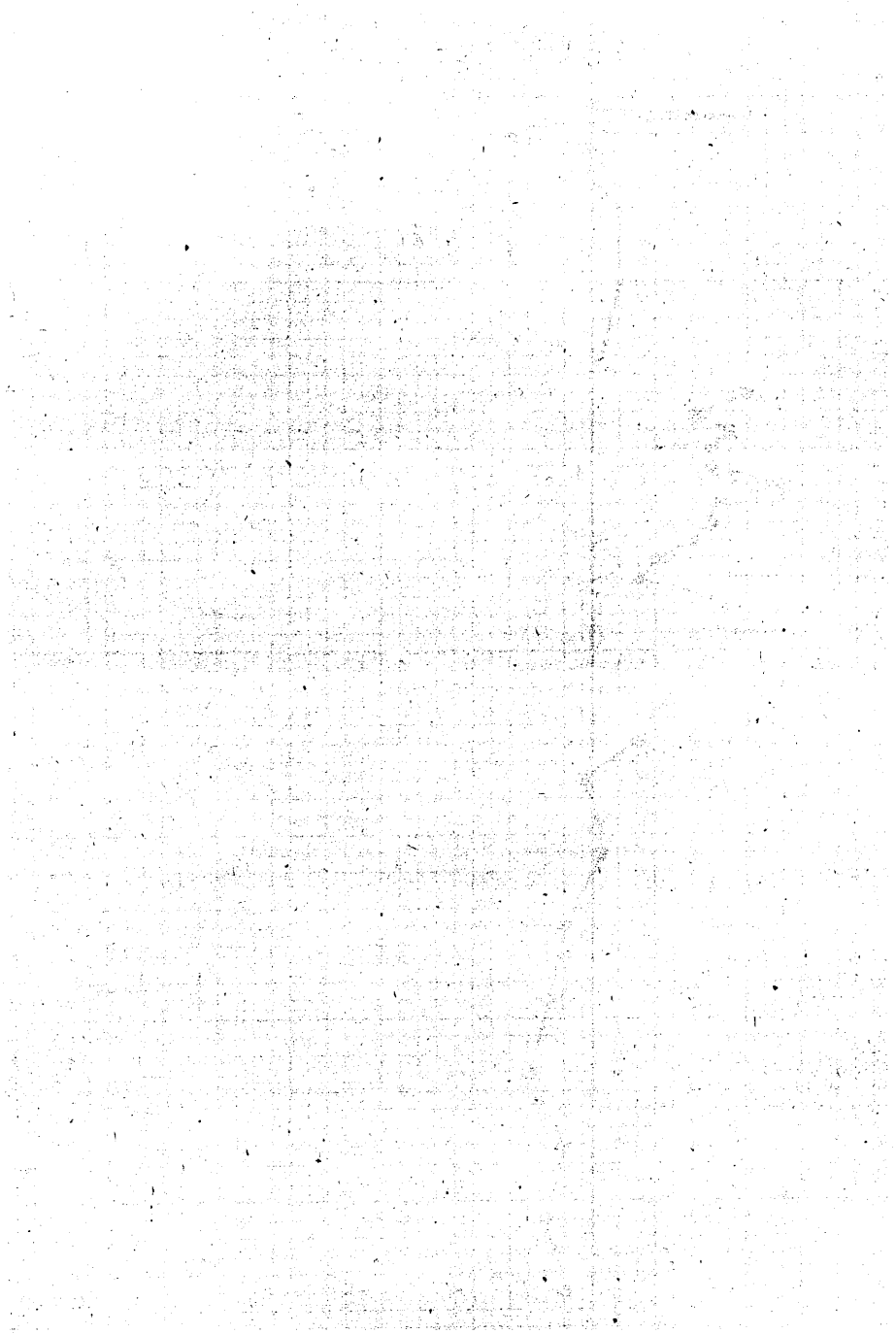
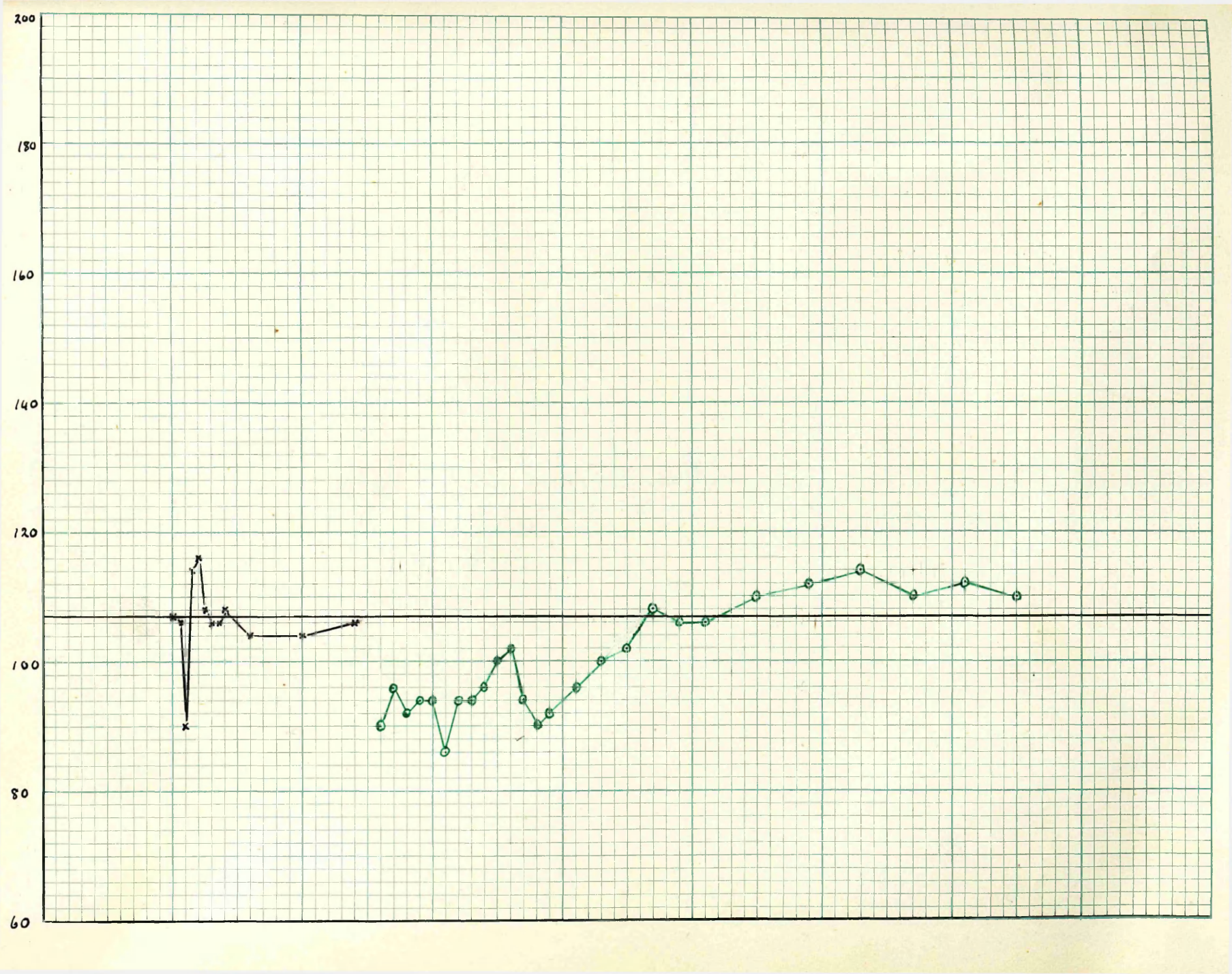
1250 BRYL H DAY 0

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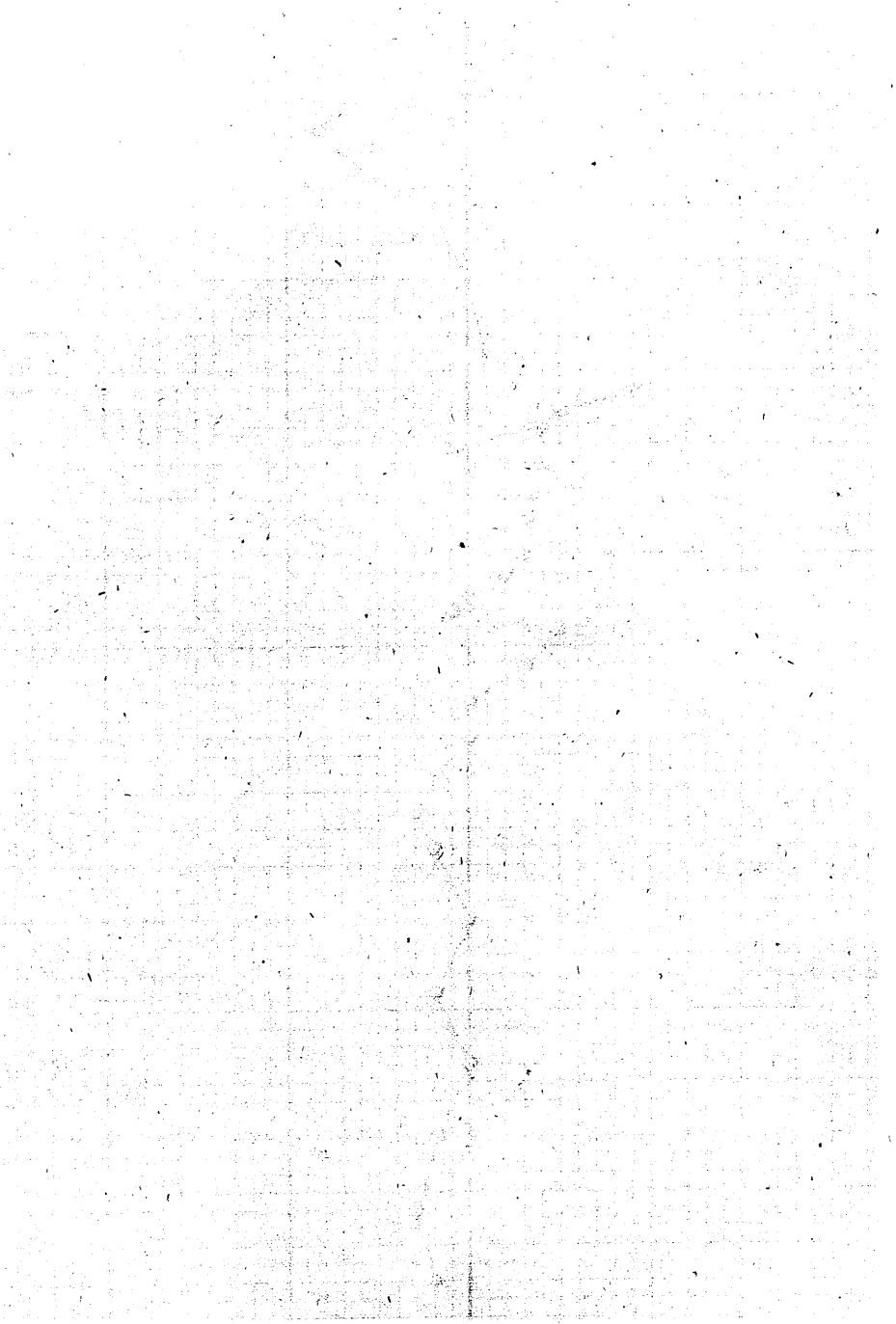
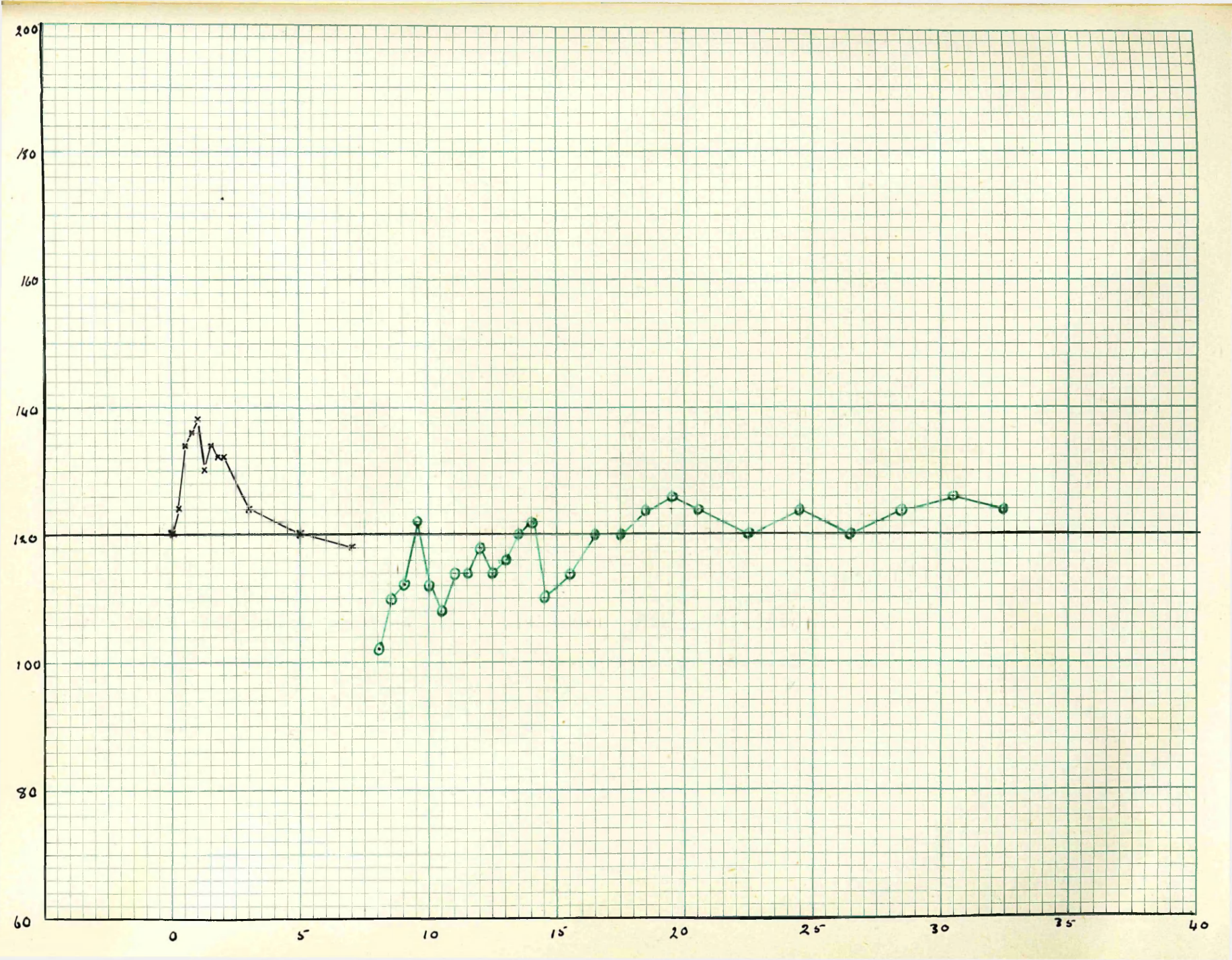
1960 ELLIS J W DAY 0

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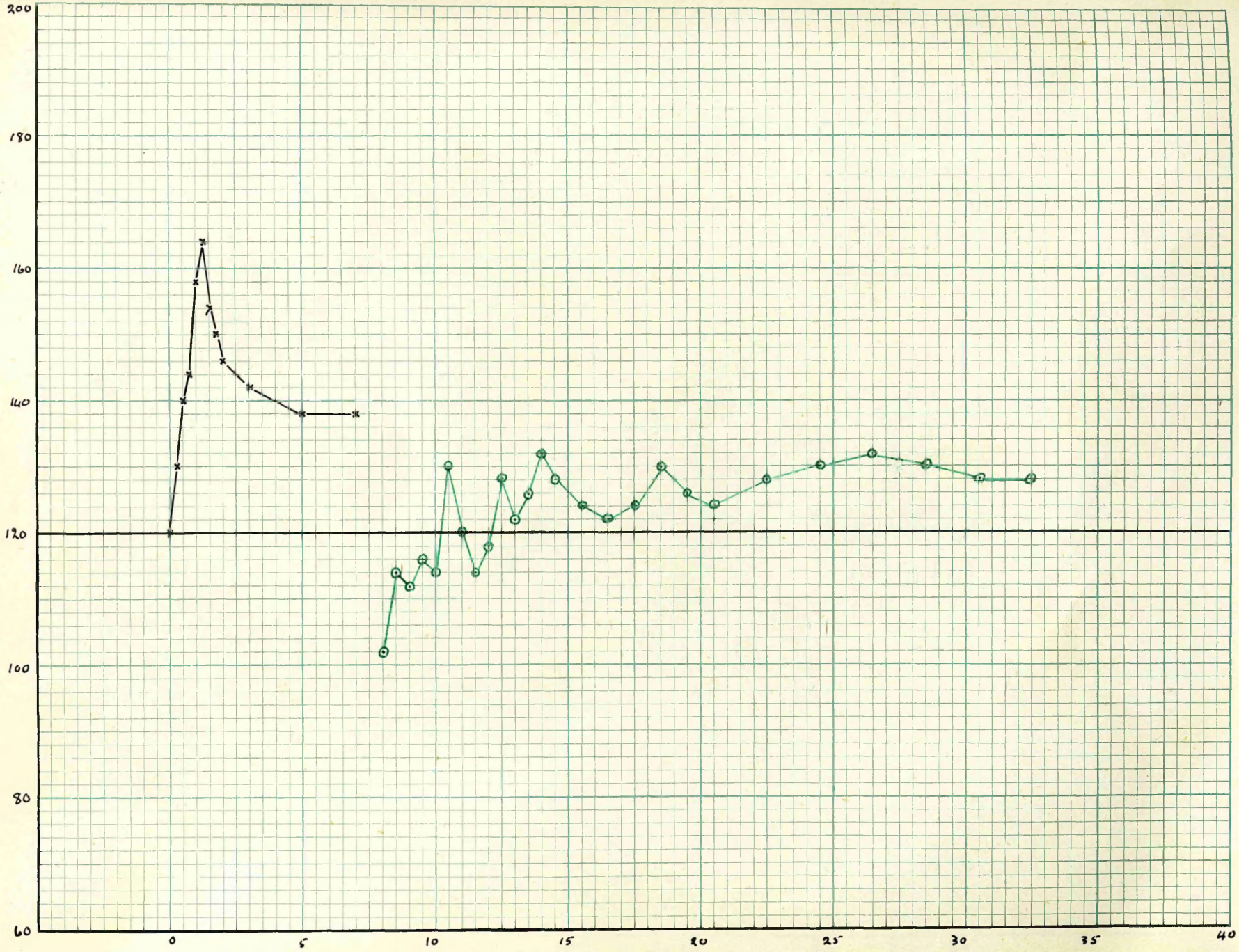
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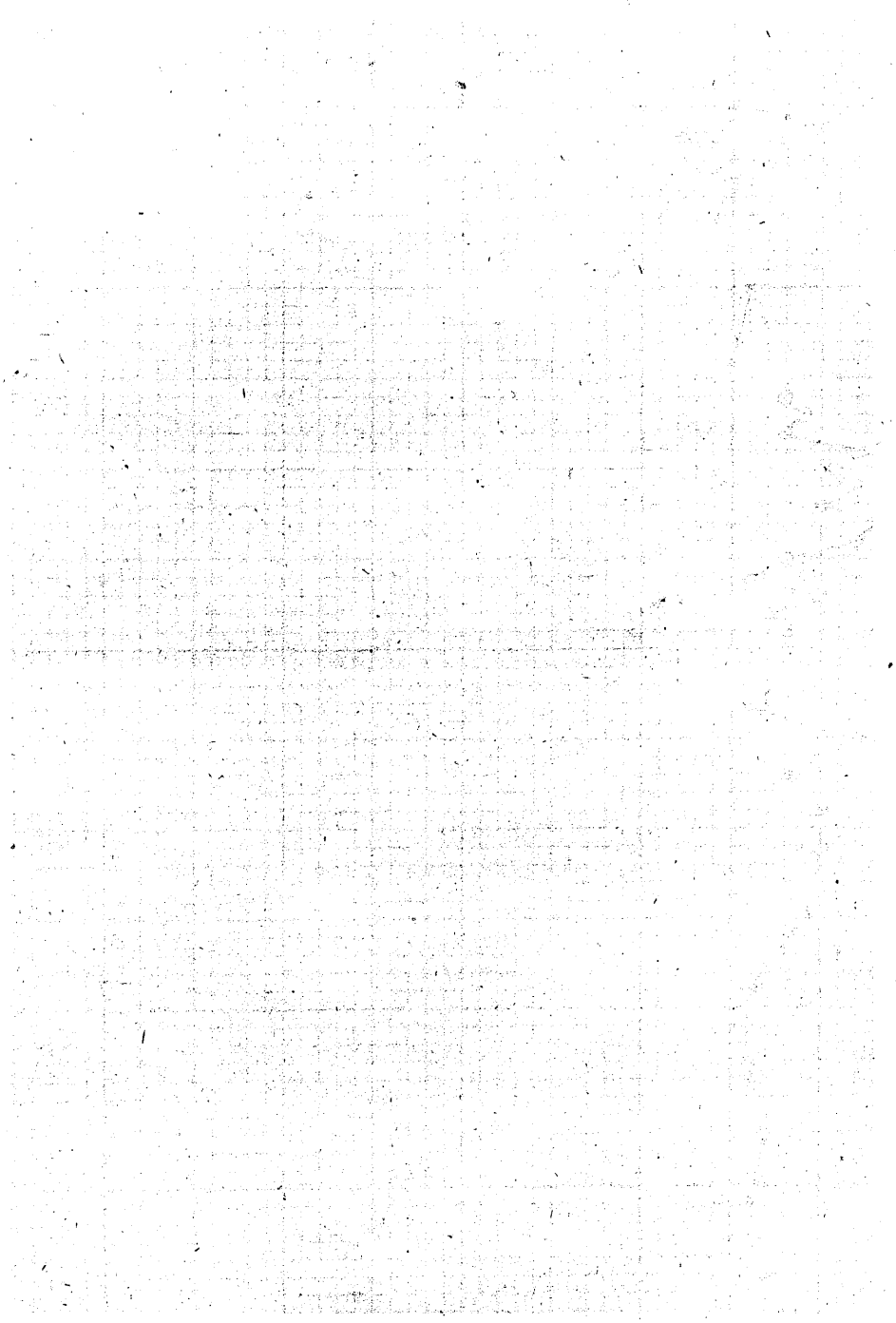
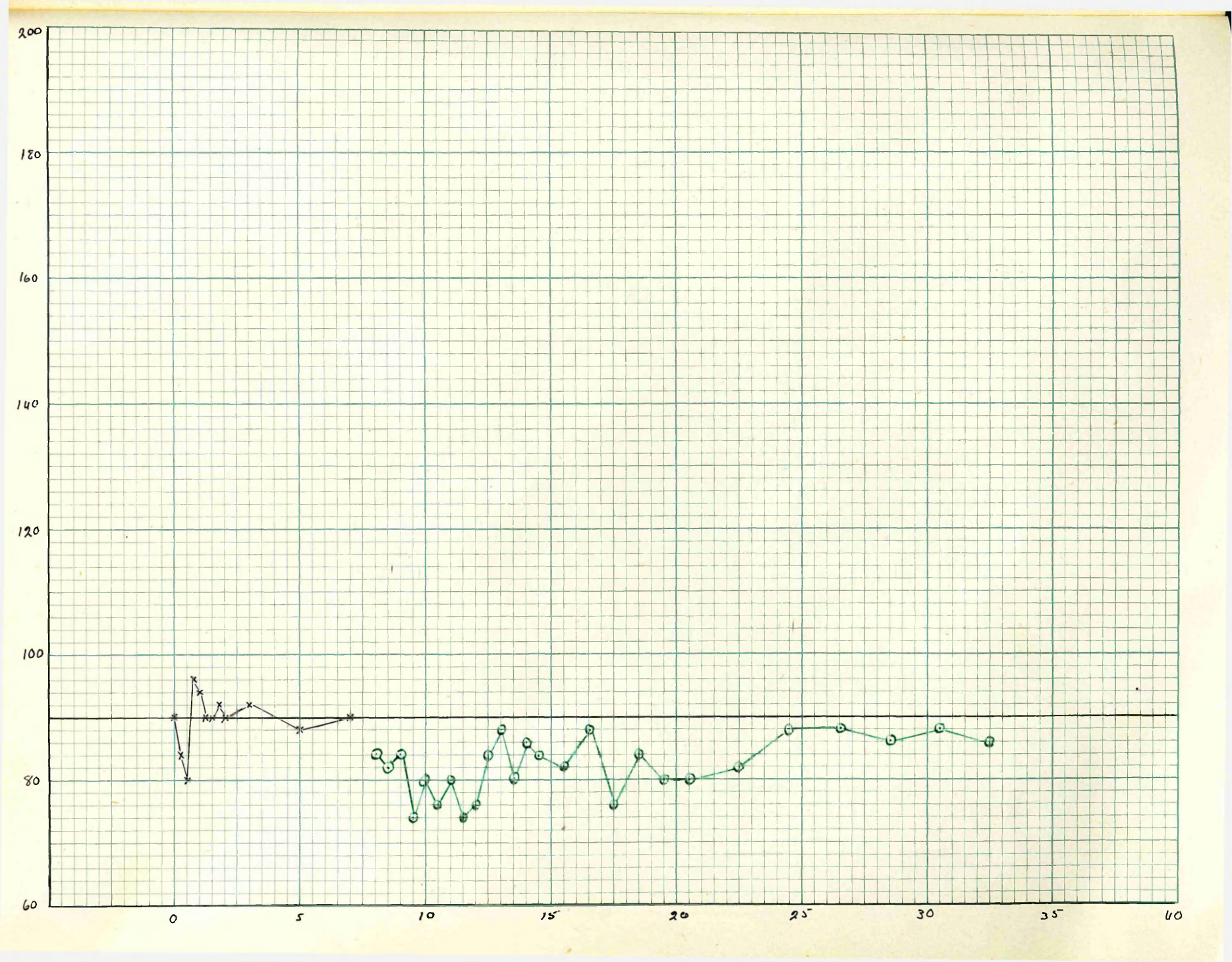
1280 BELLWOOD R. DAY 0

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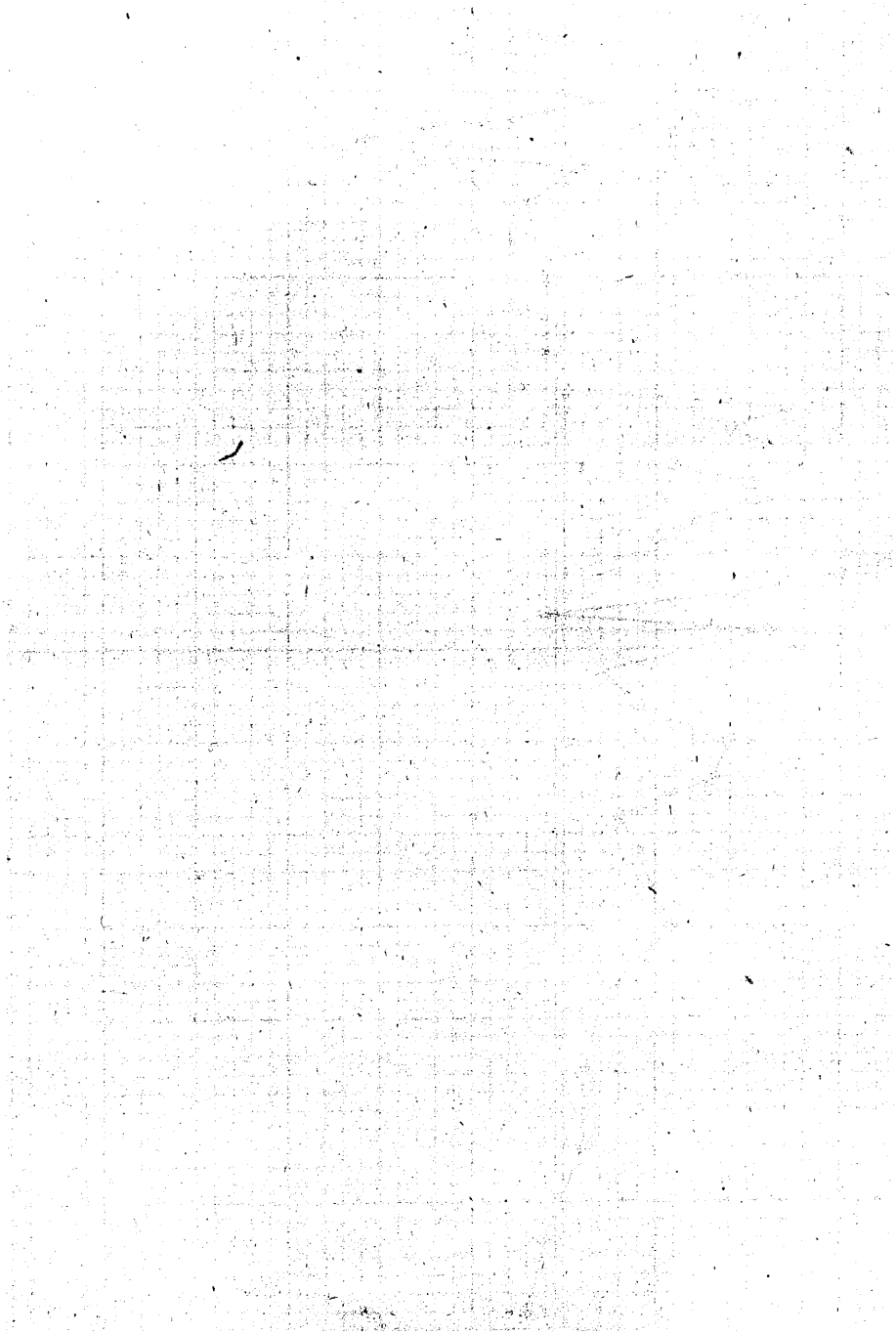
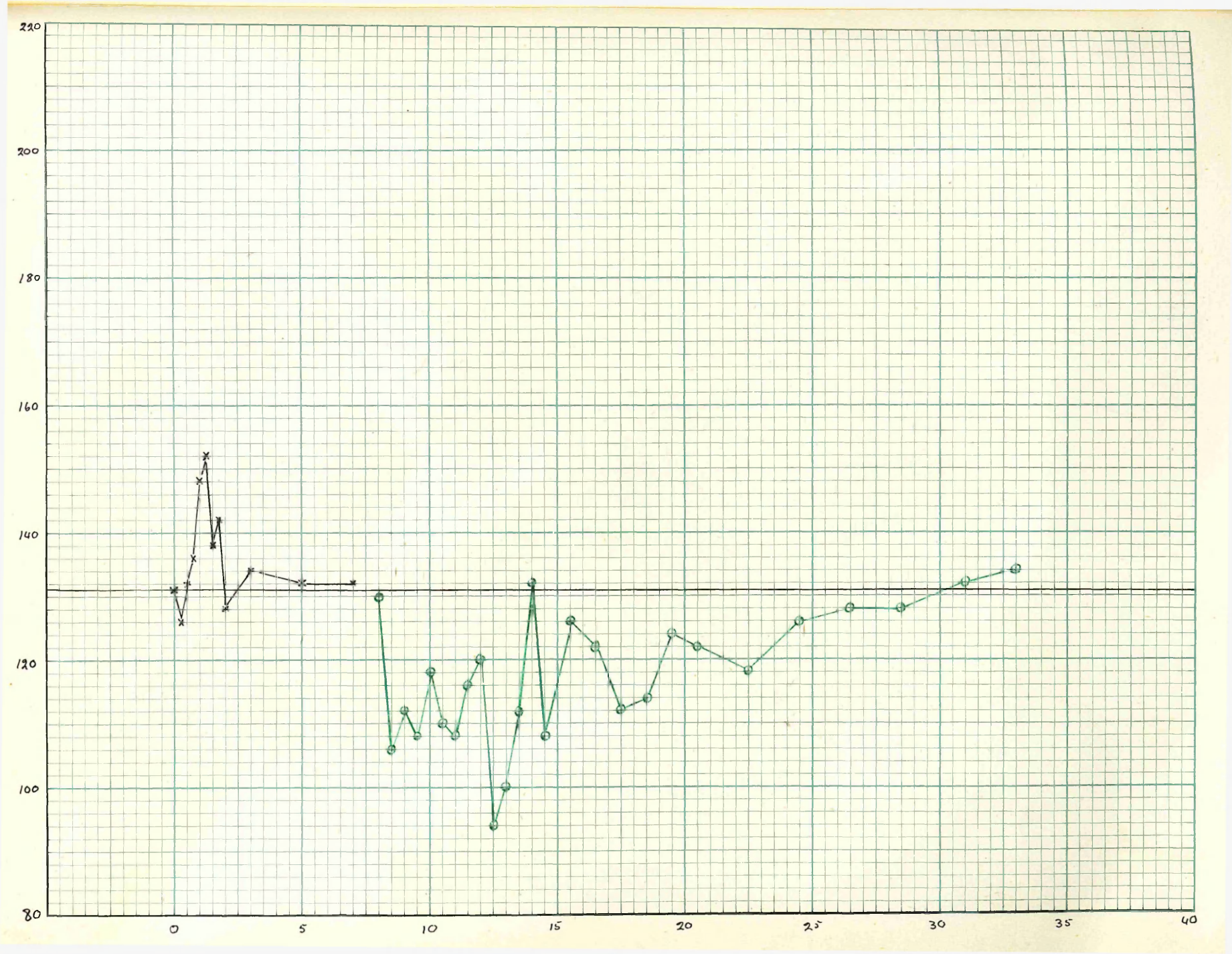
1290 WARD A. DAY 0

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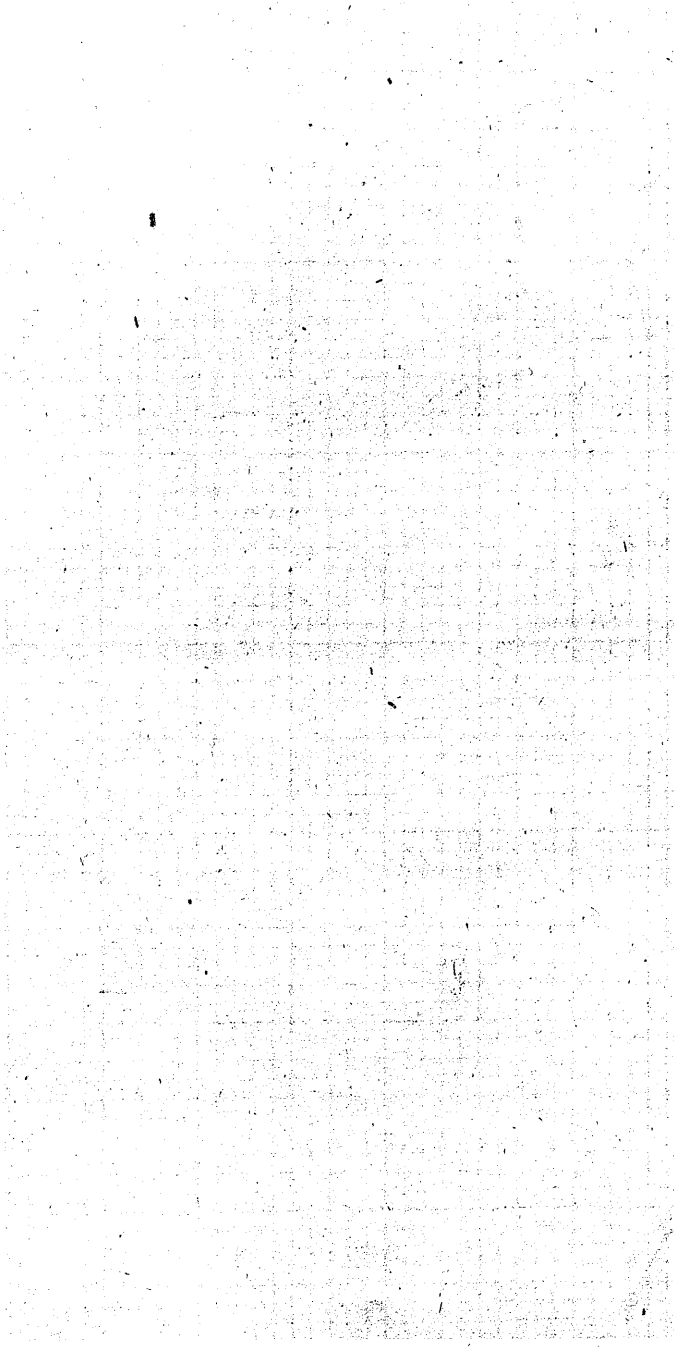
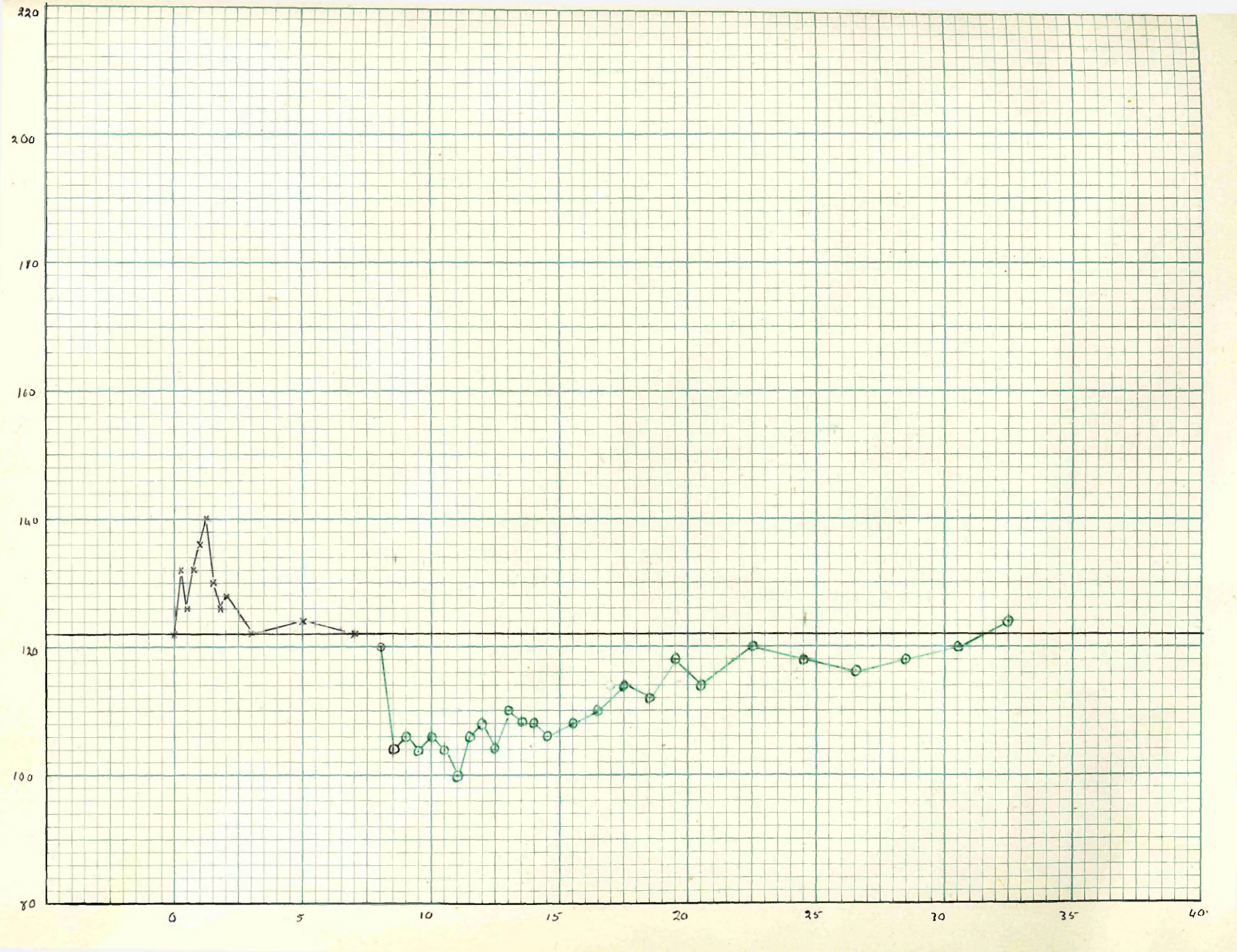
1300 SMITH S DAY 0

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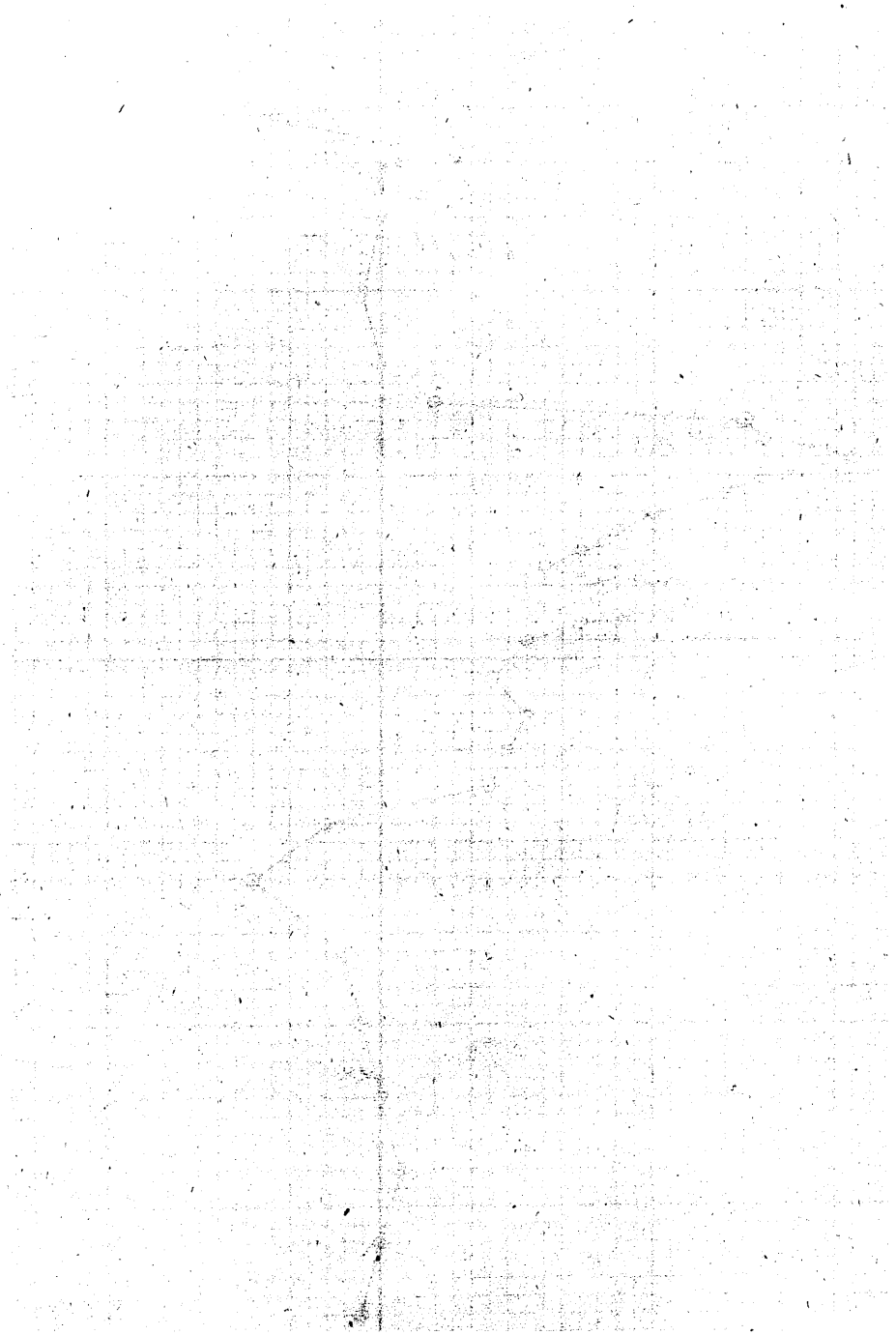

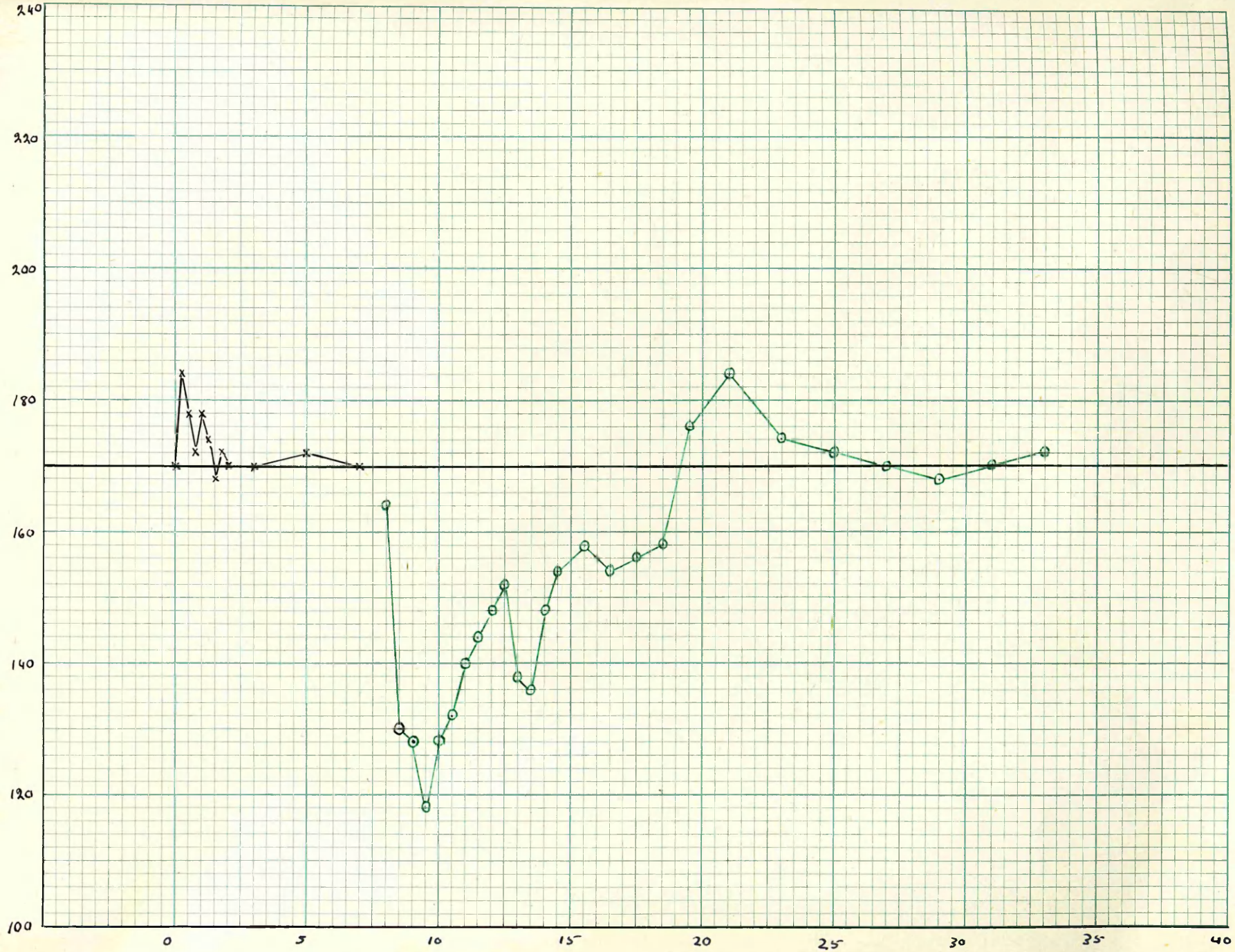
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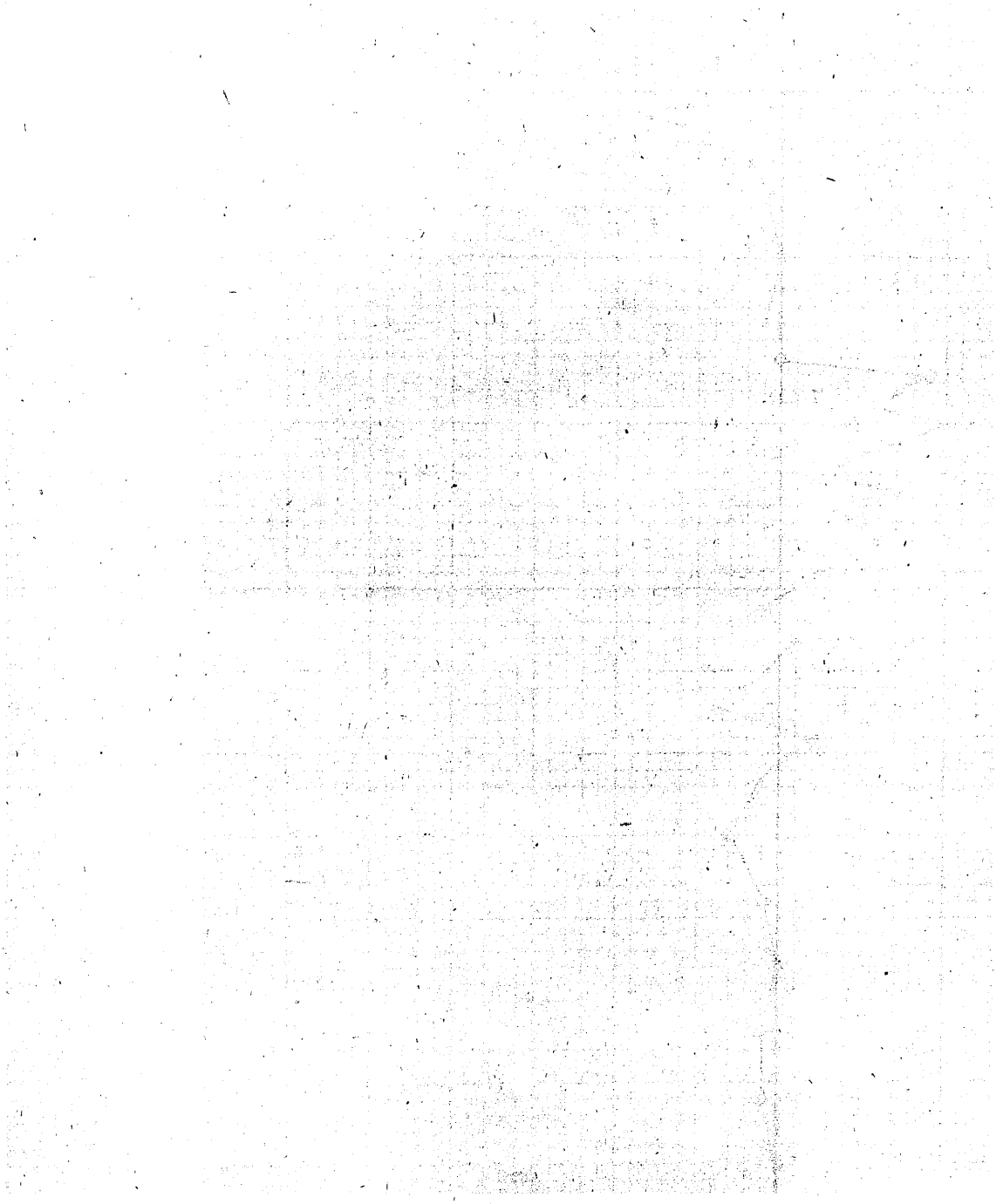

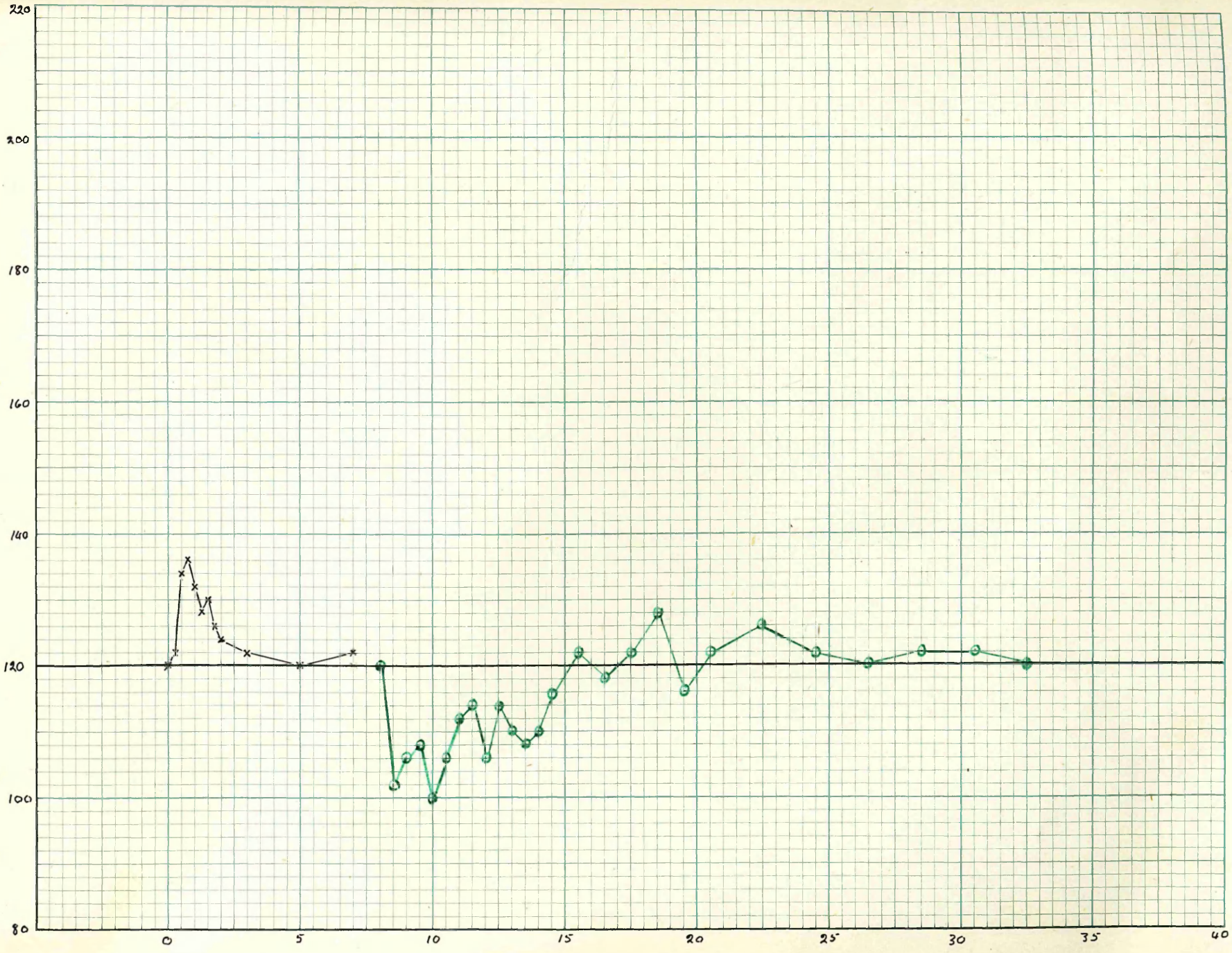
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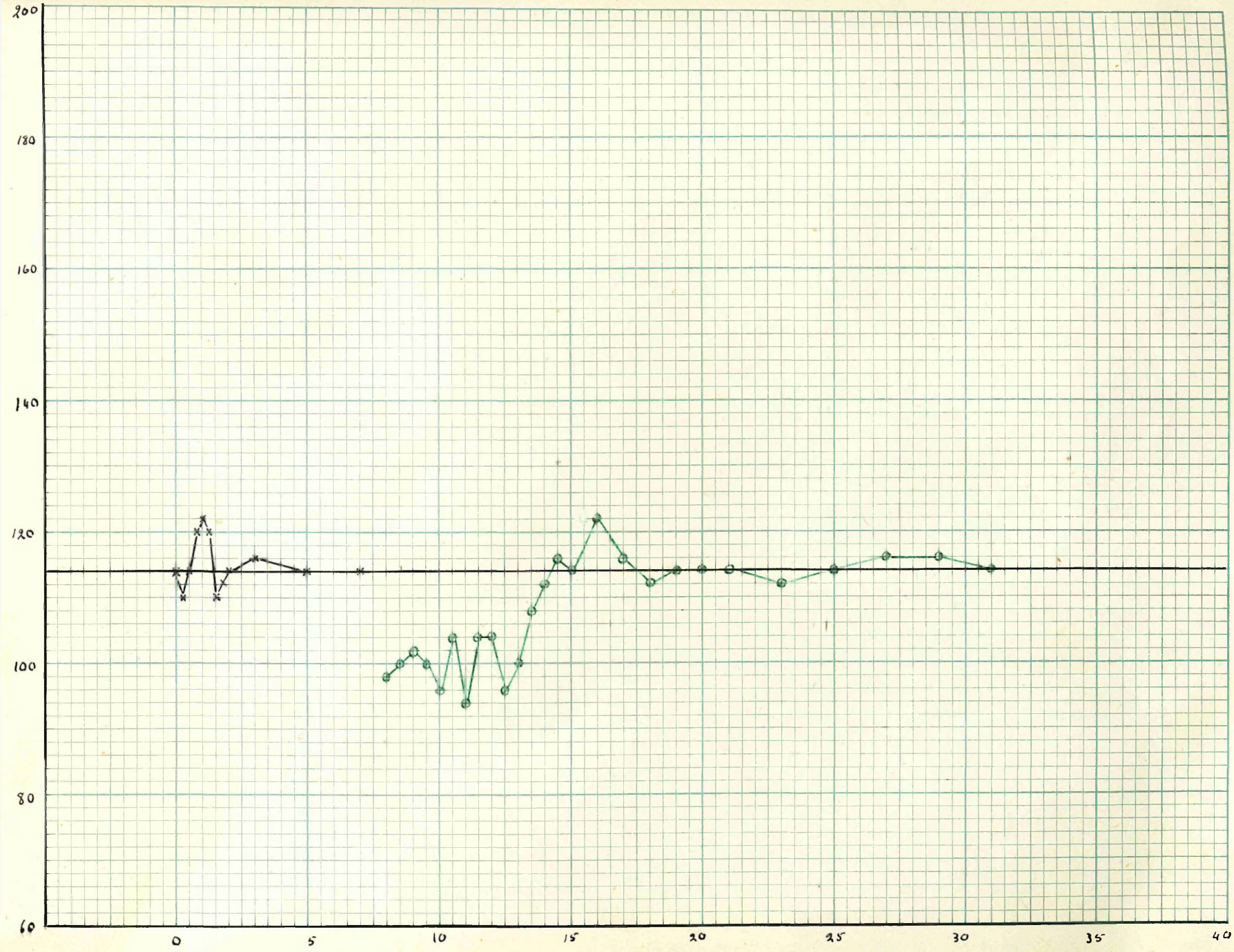
1330 DIXON GB DAY 0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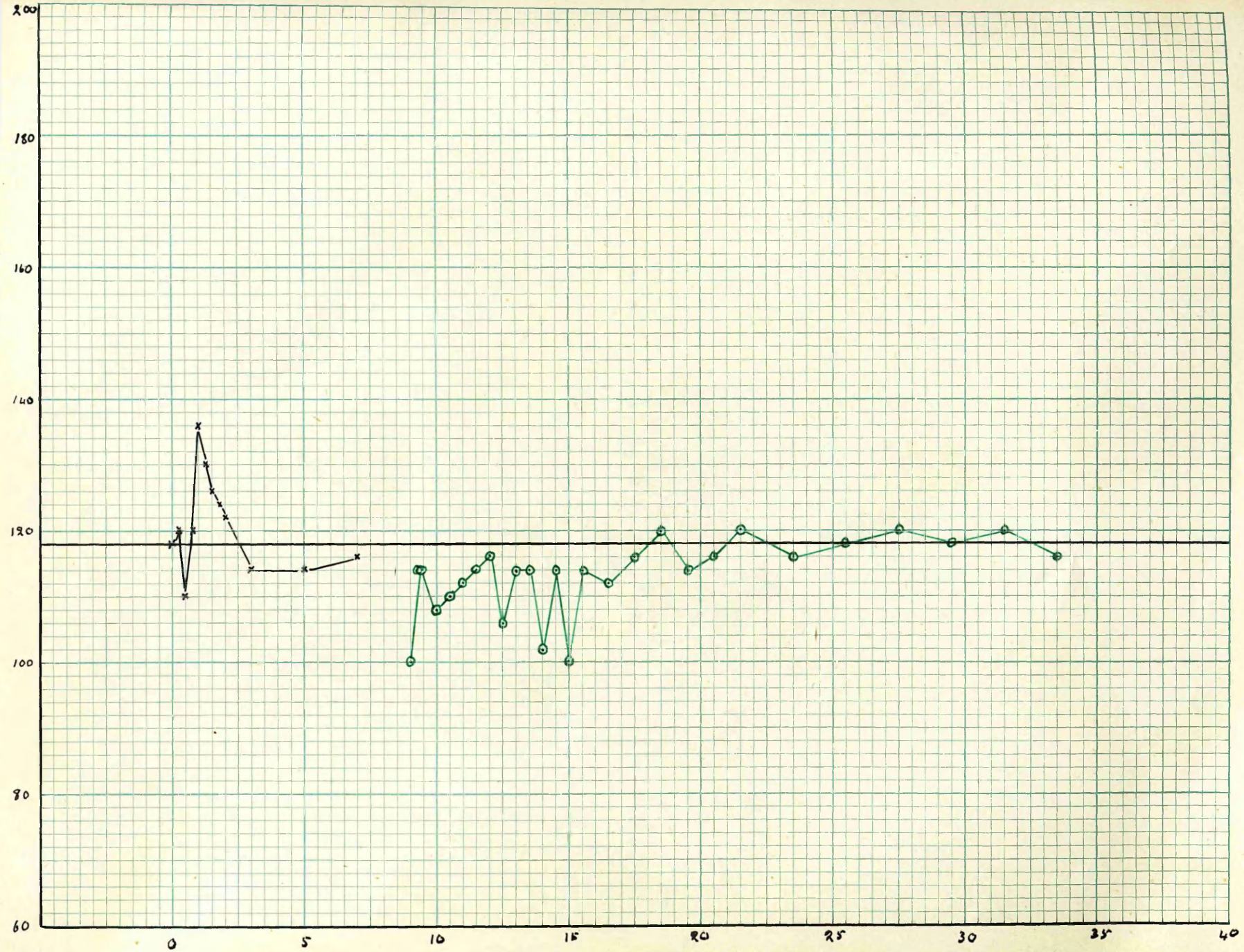
1340 MYSHINSKY F PAY O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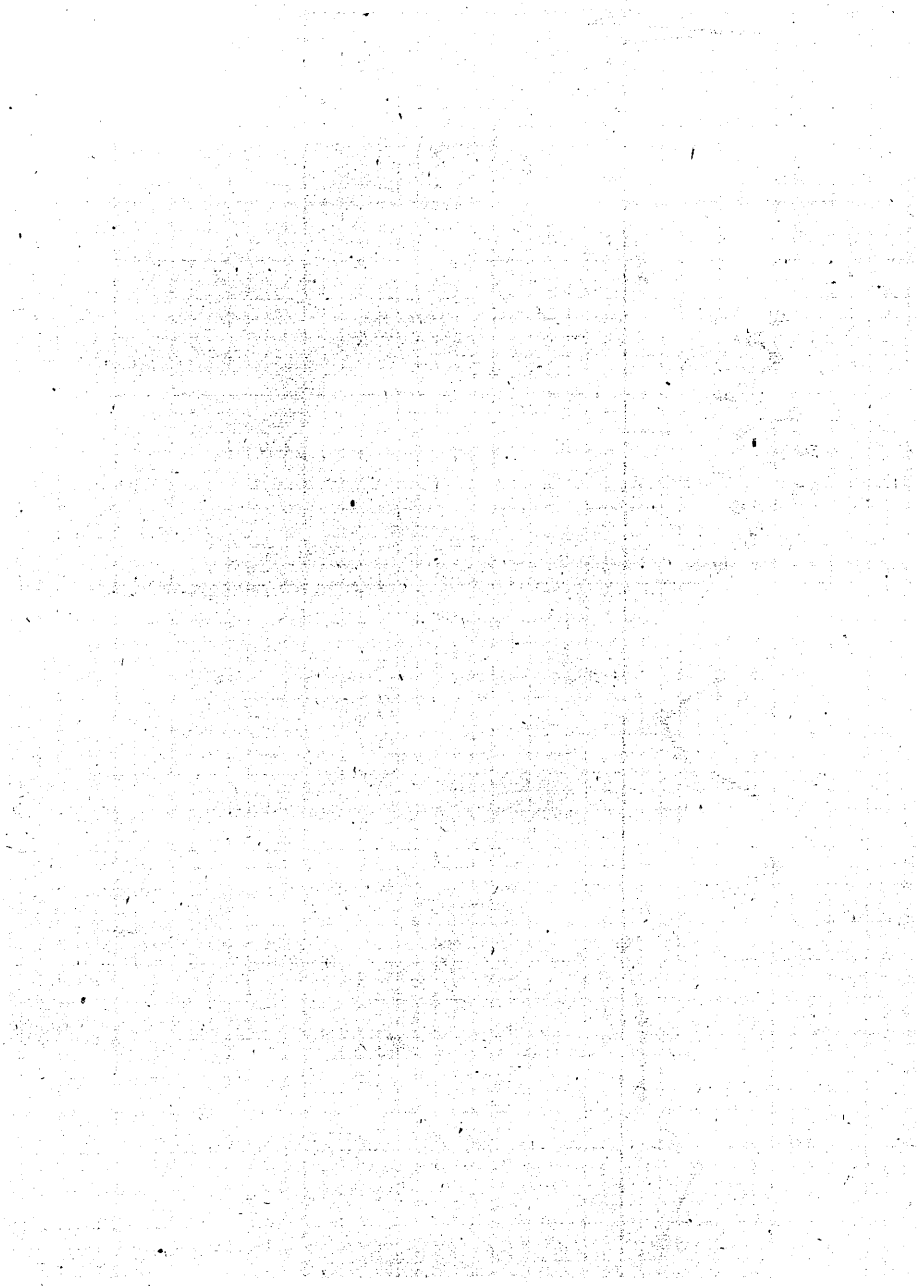
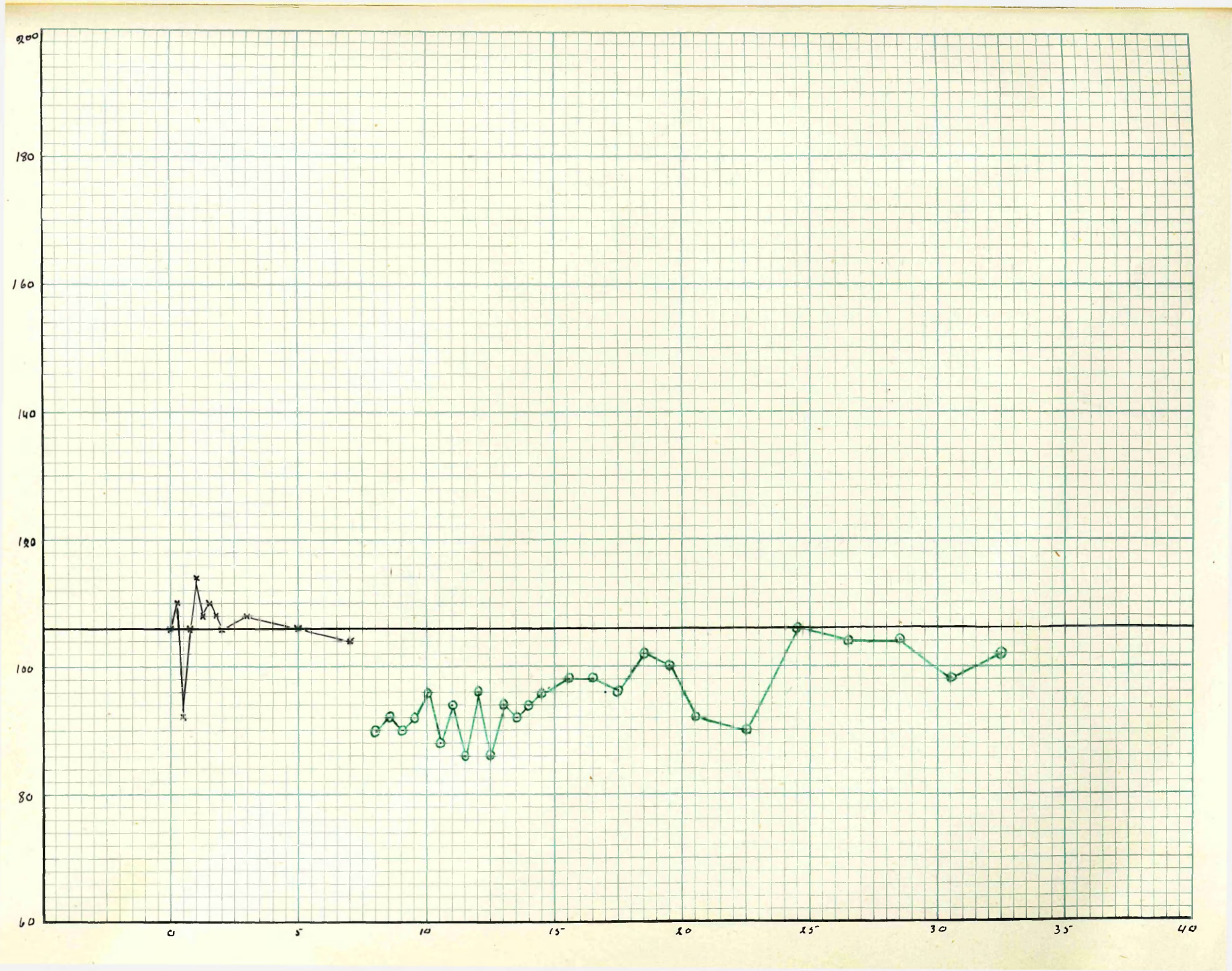
1350 COPELSTON F.A. DAY 0

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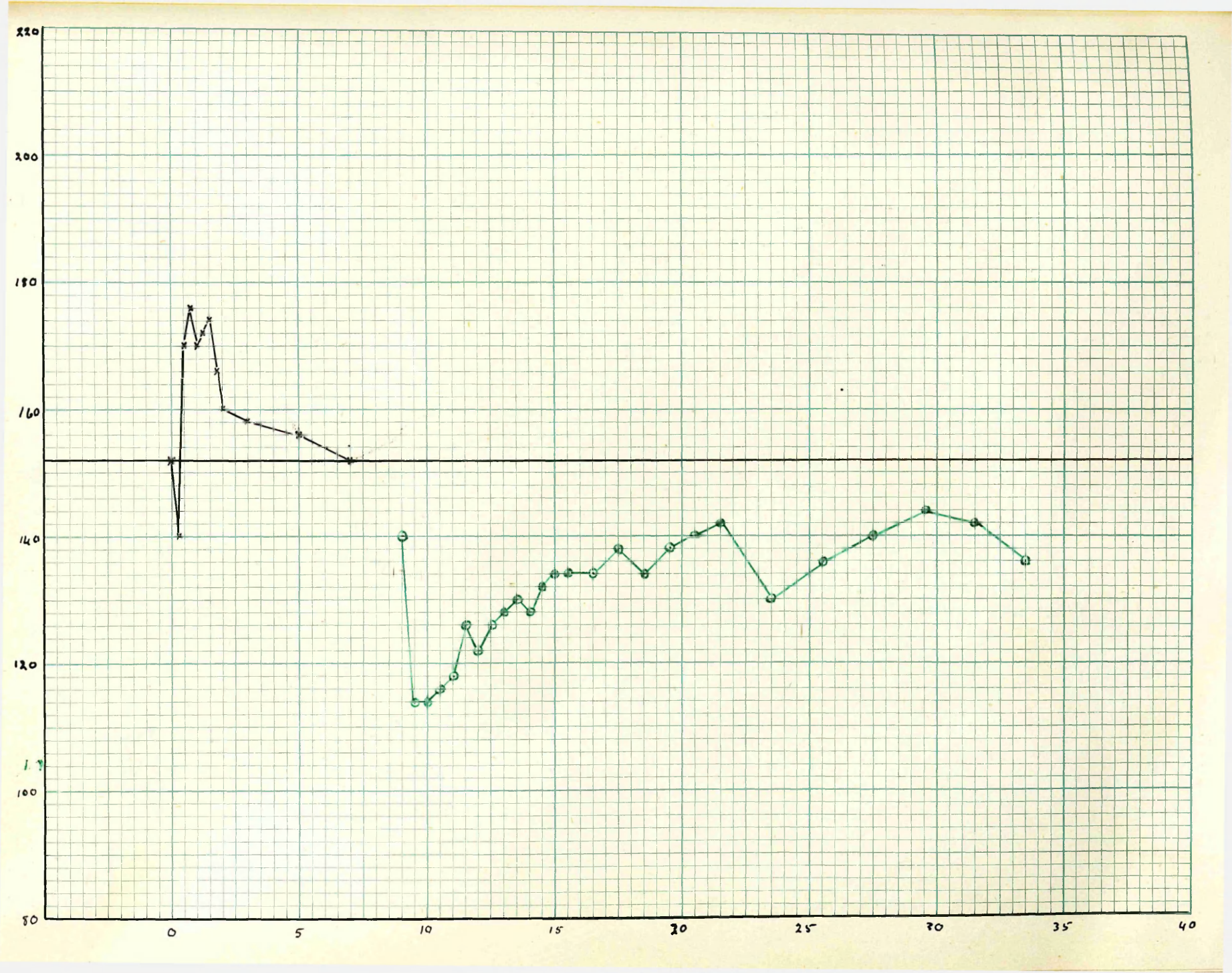
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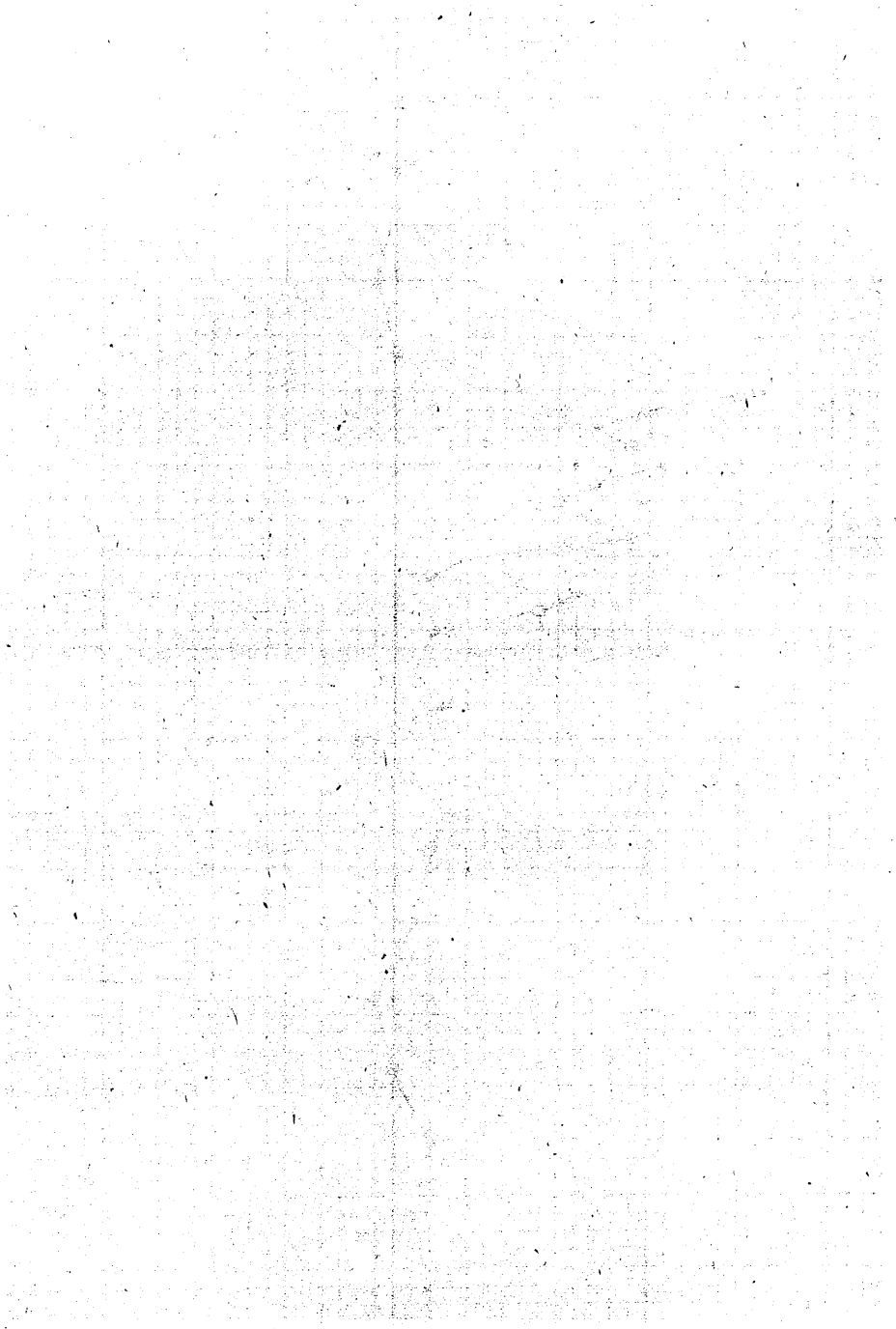
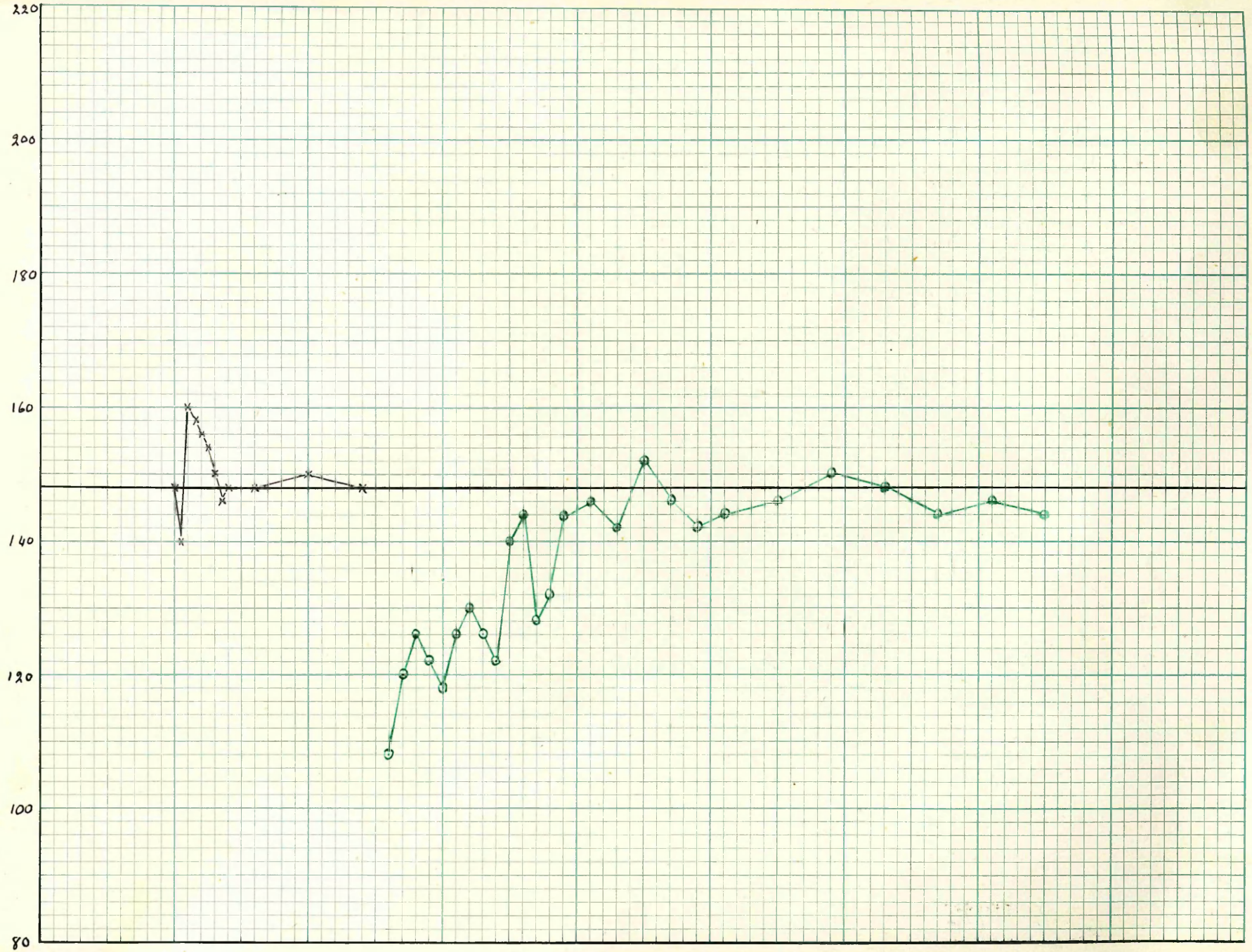
1340 ROBINS R DAY 0

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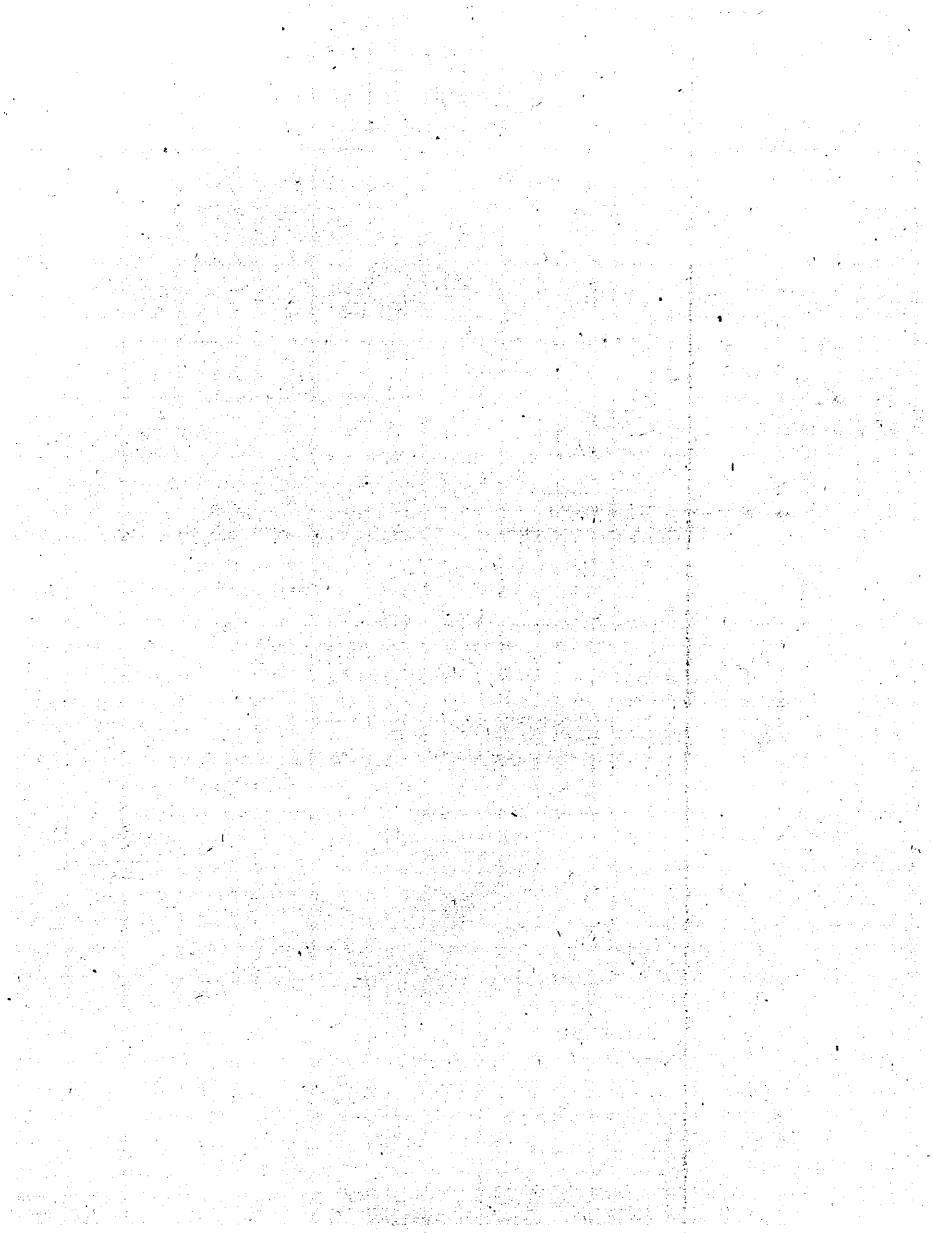

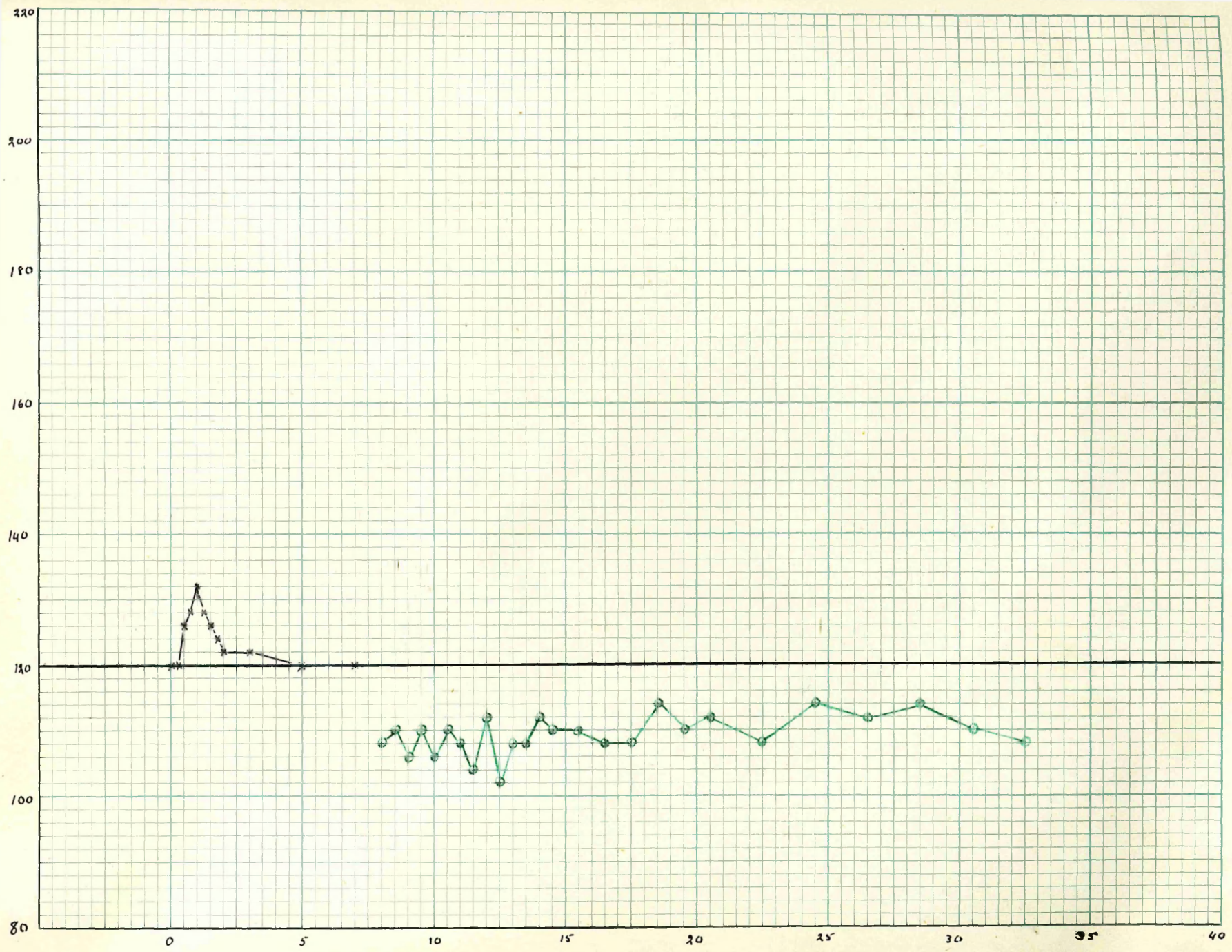
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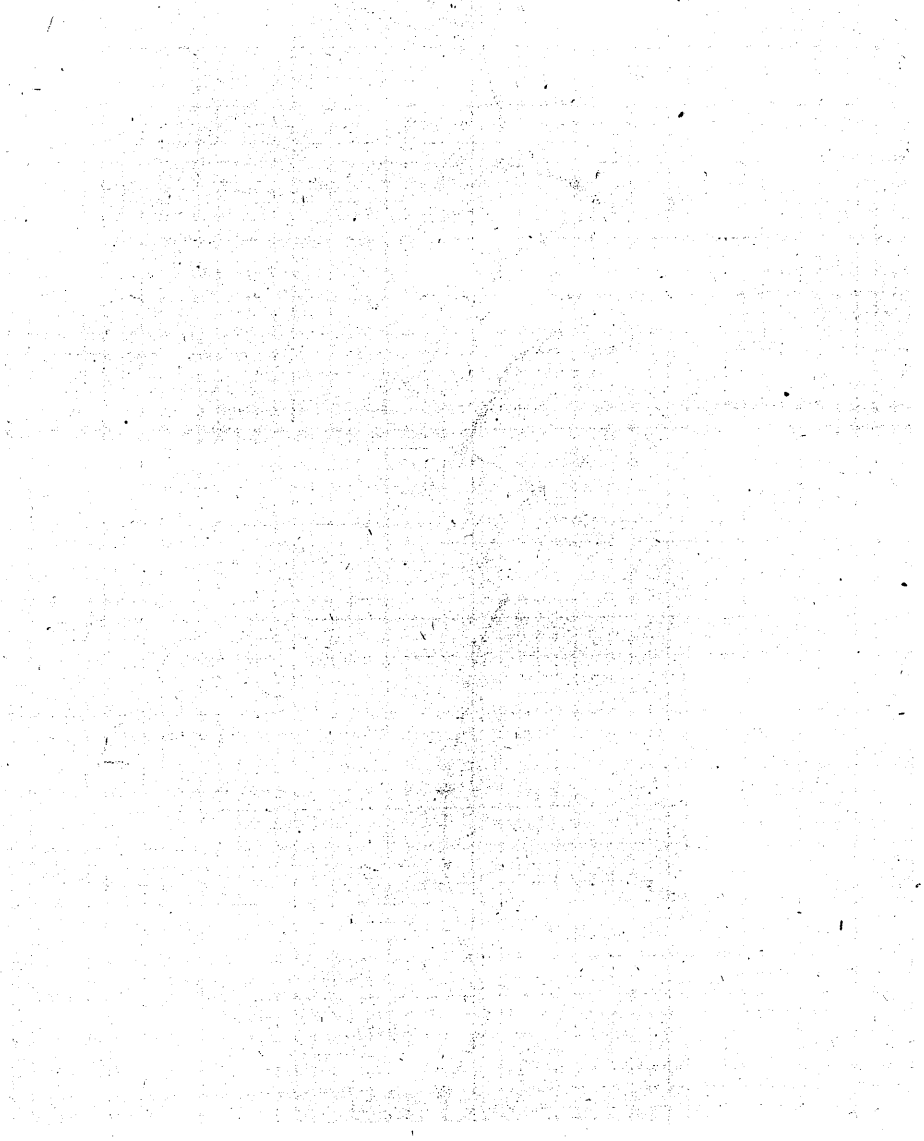
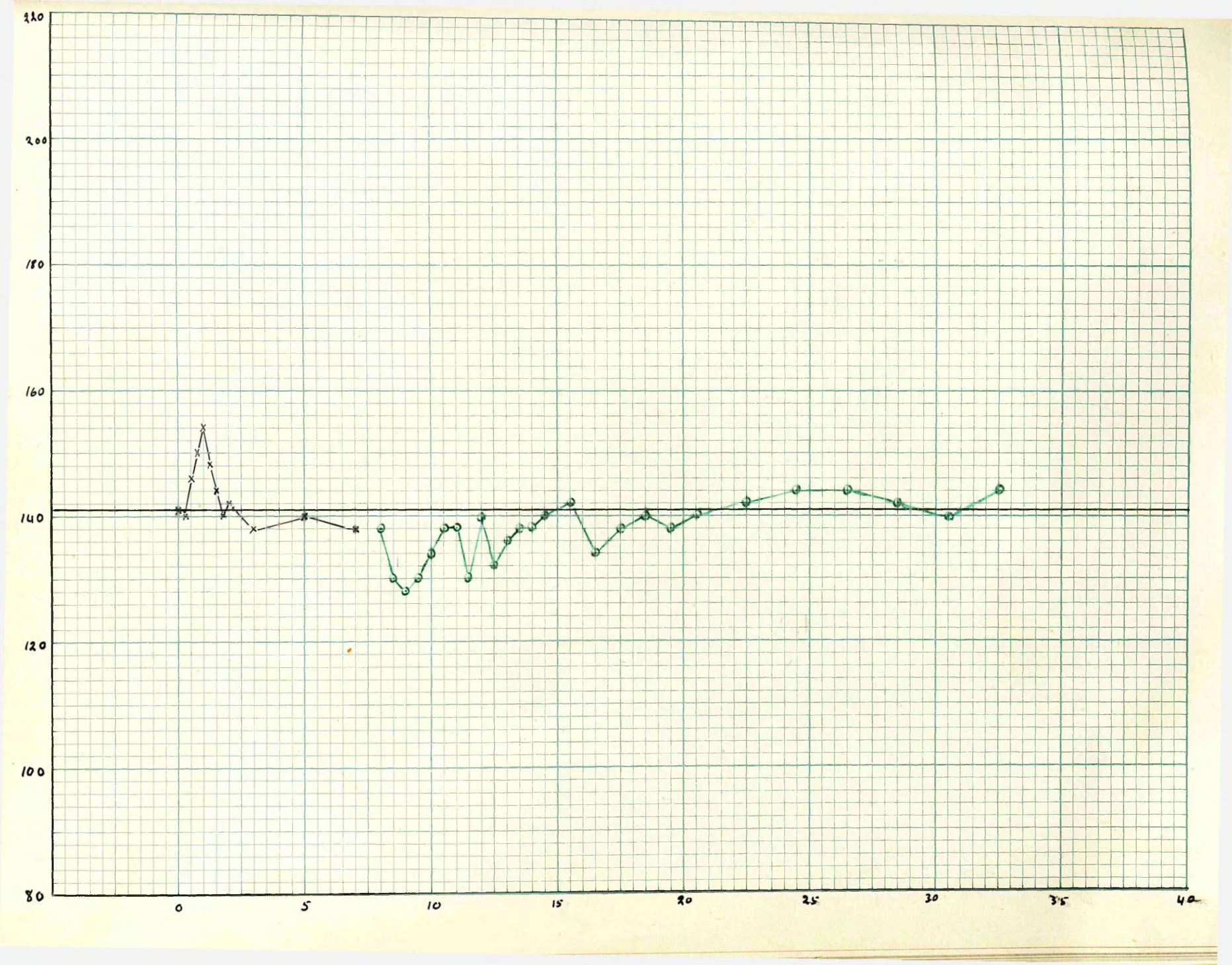
1390 WOOD B DAY 0

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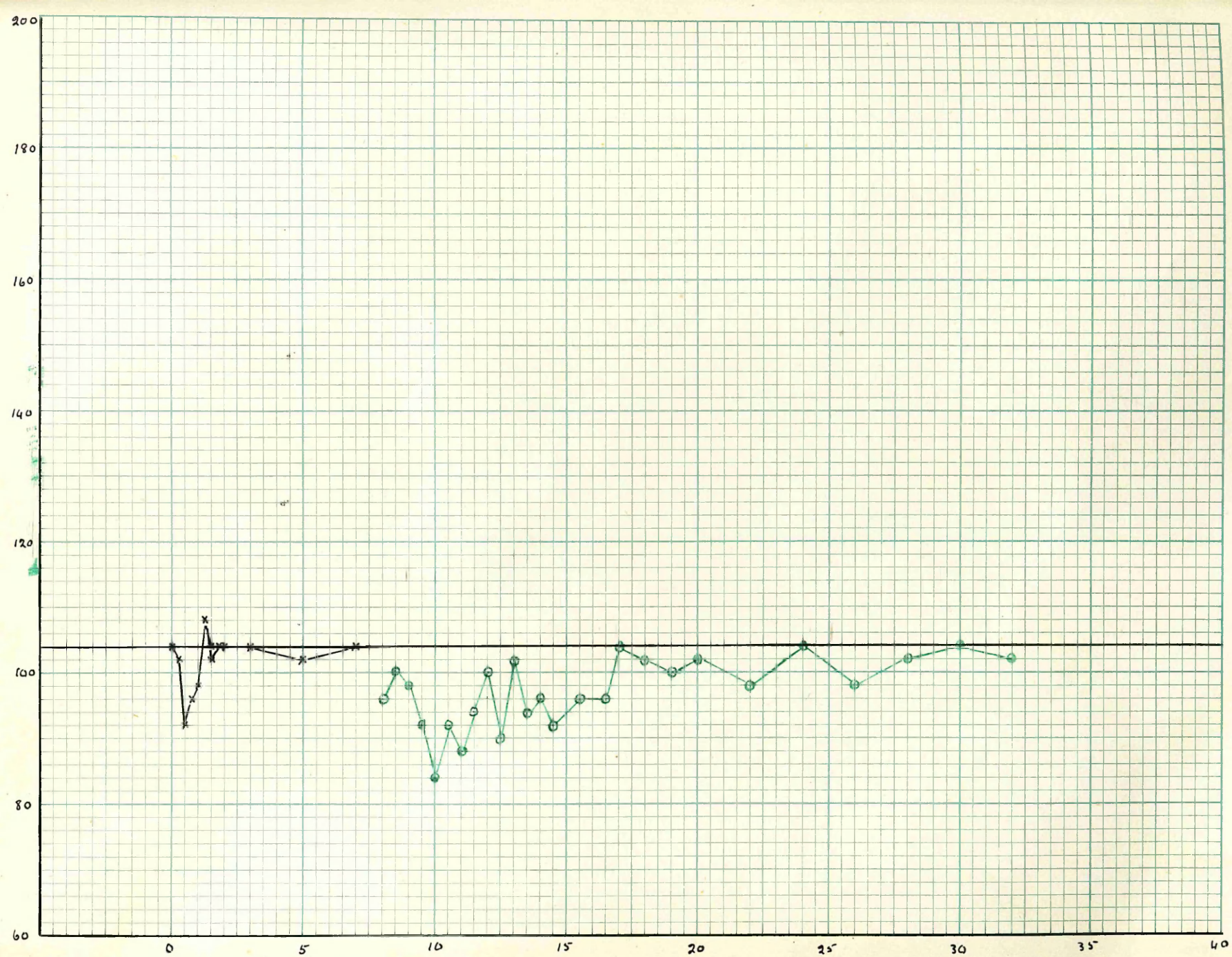
1400 BROGDEN J.B. DAY 0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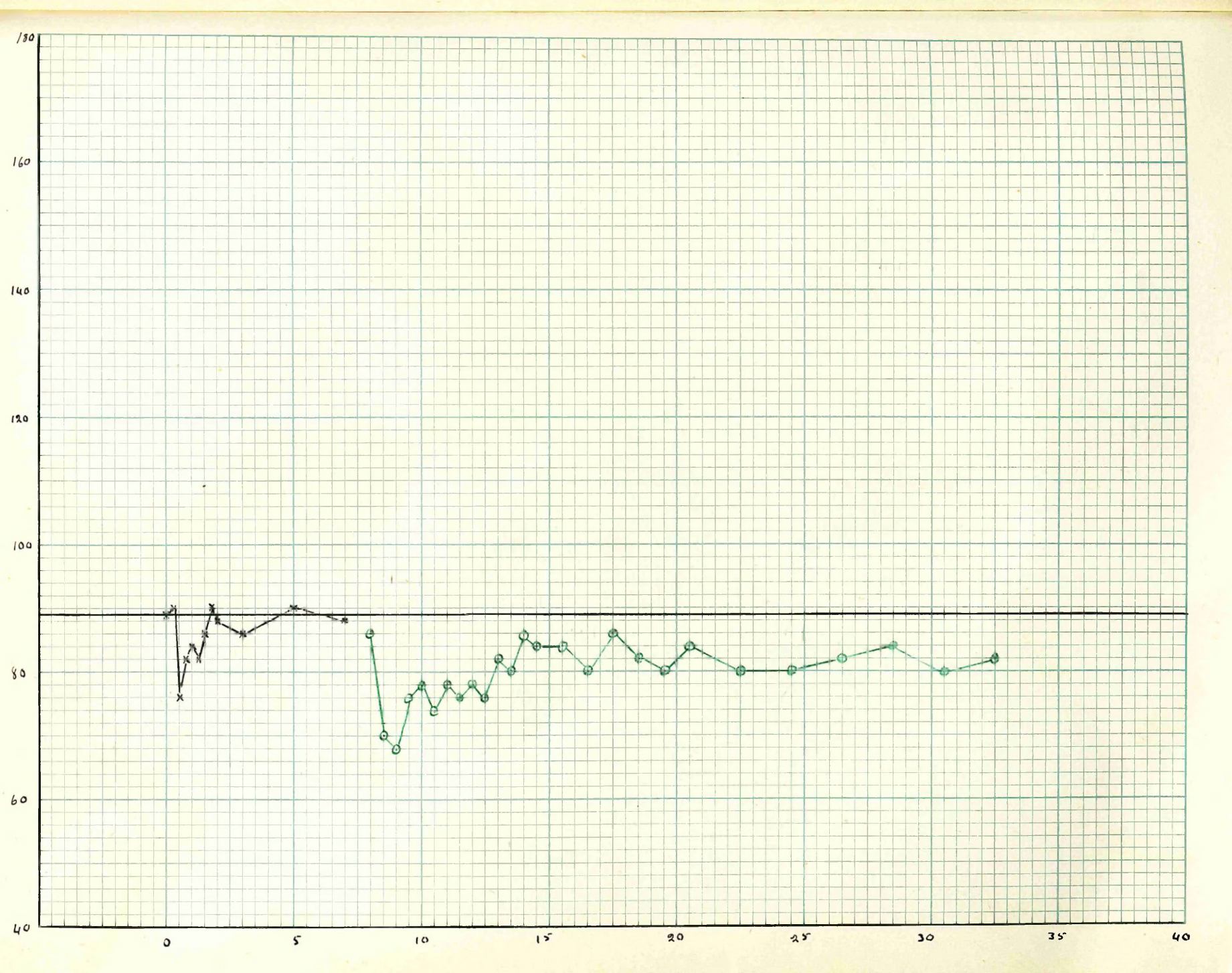
1410 SMITH I (JUN) DAY 0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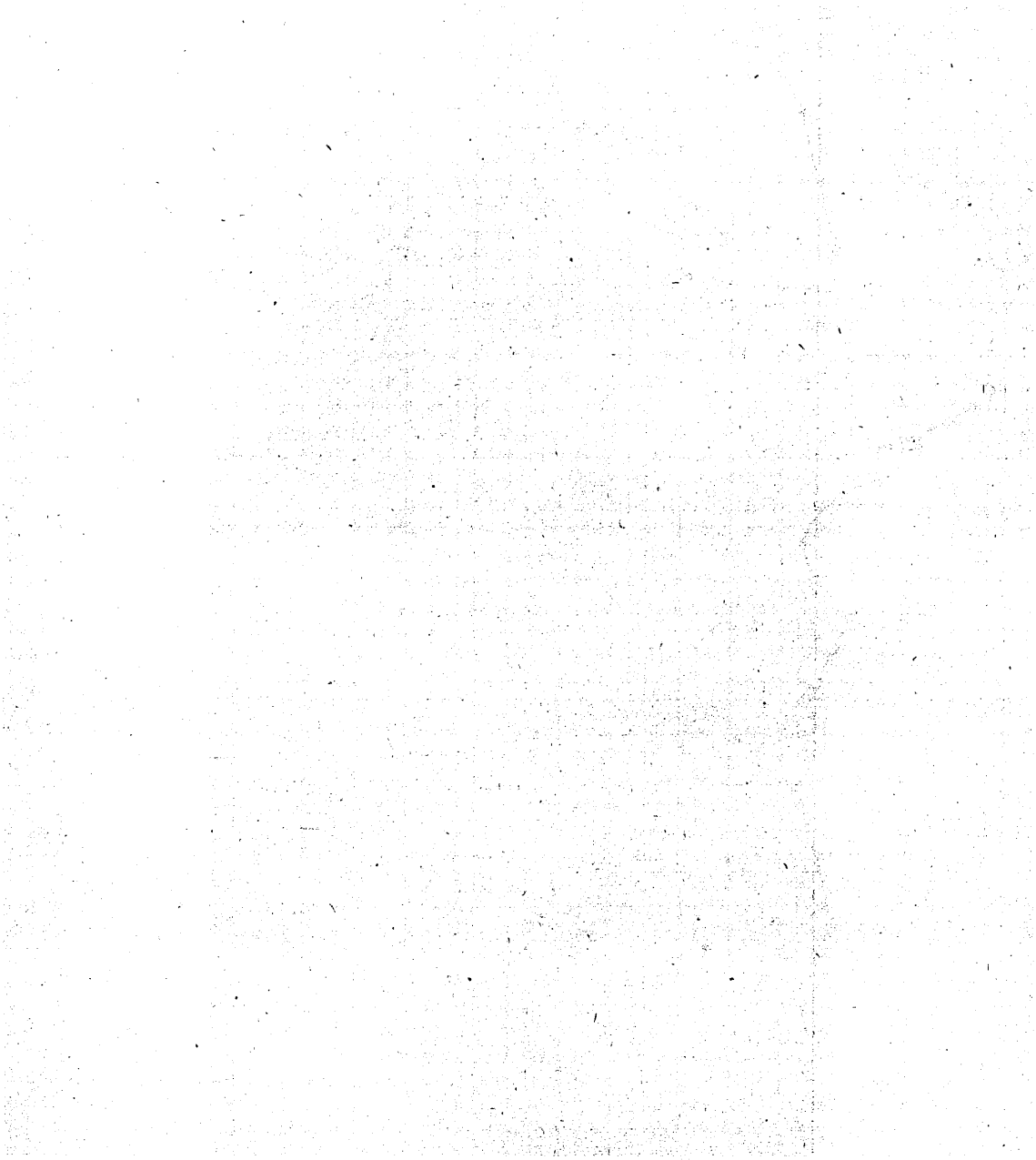


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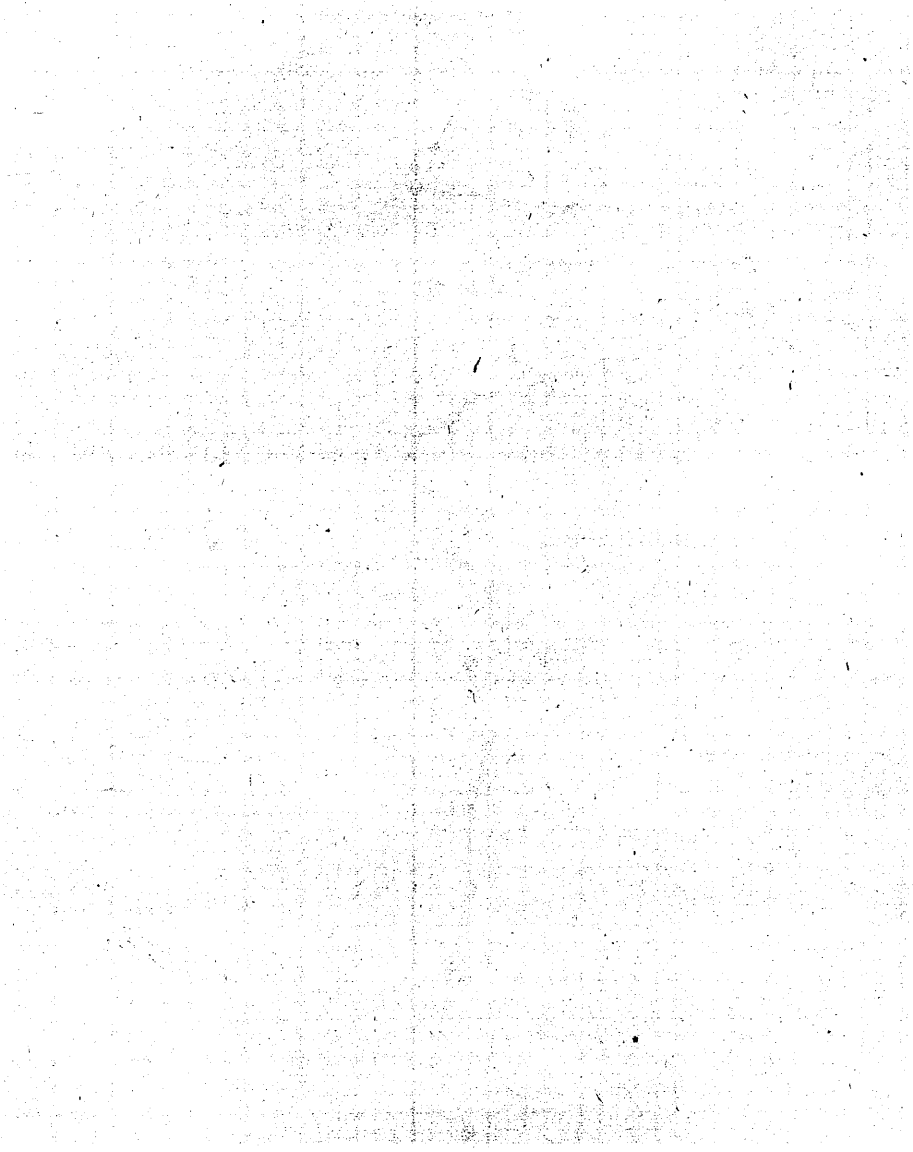

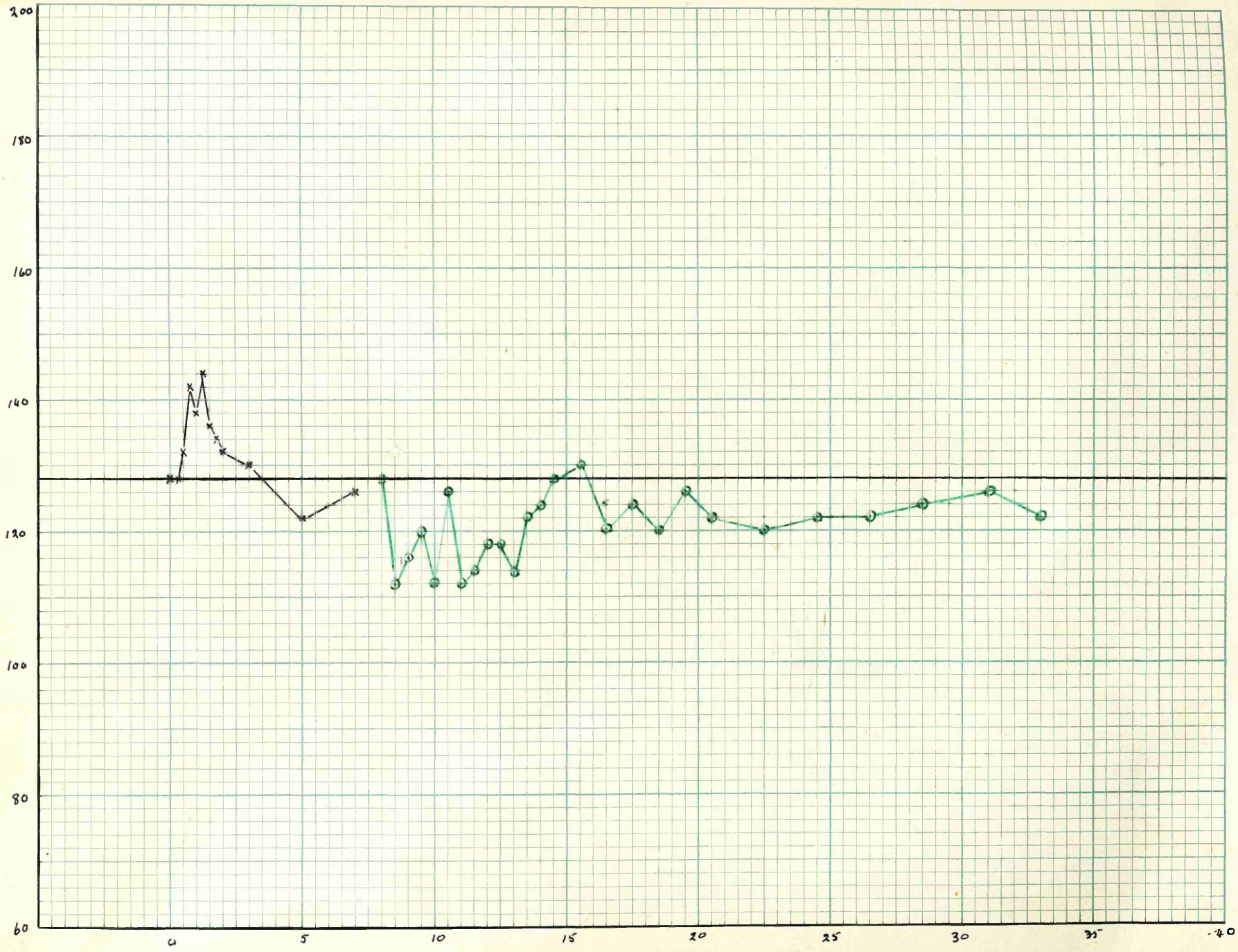
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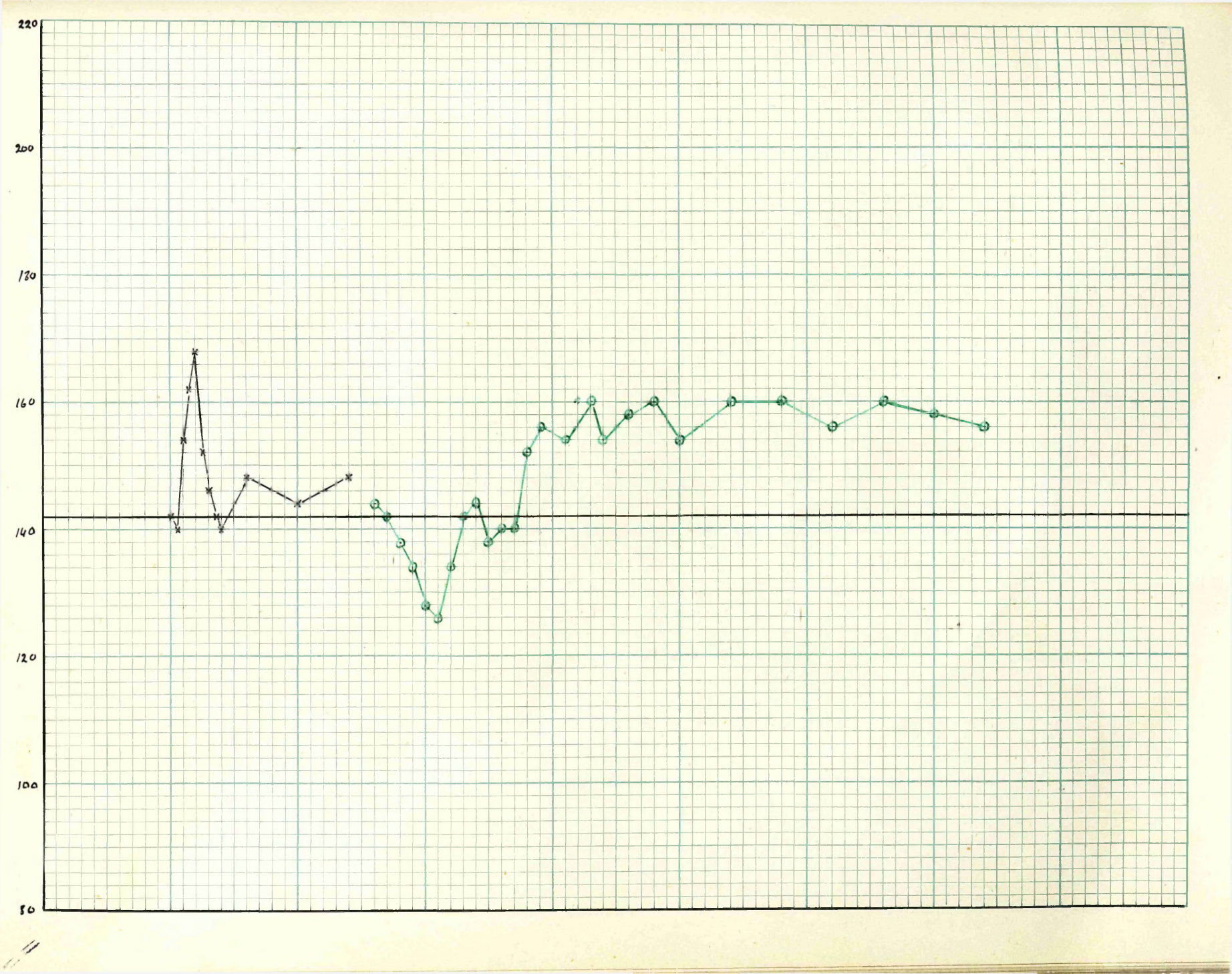
1440 PARKY A DAY 0


220
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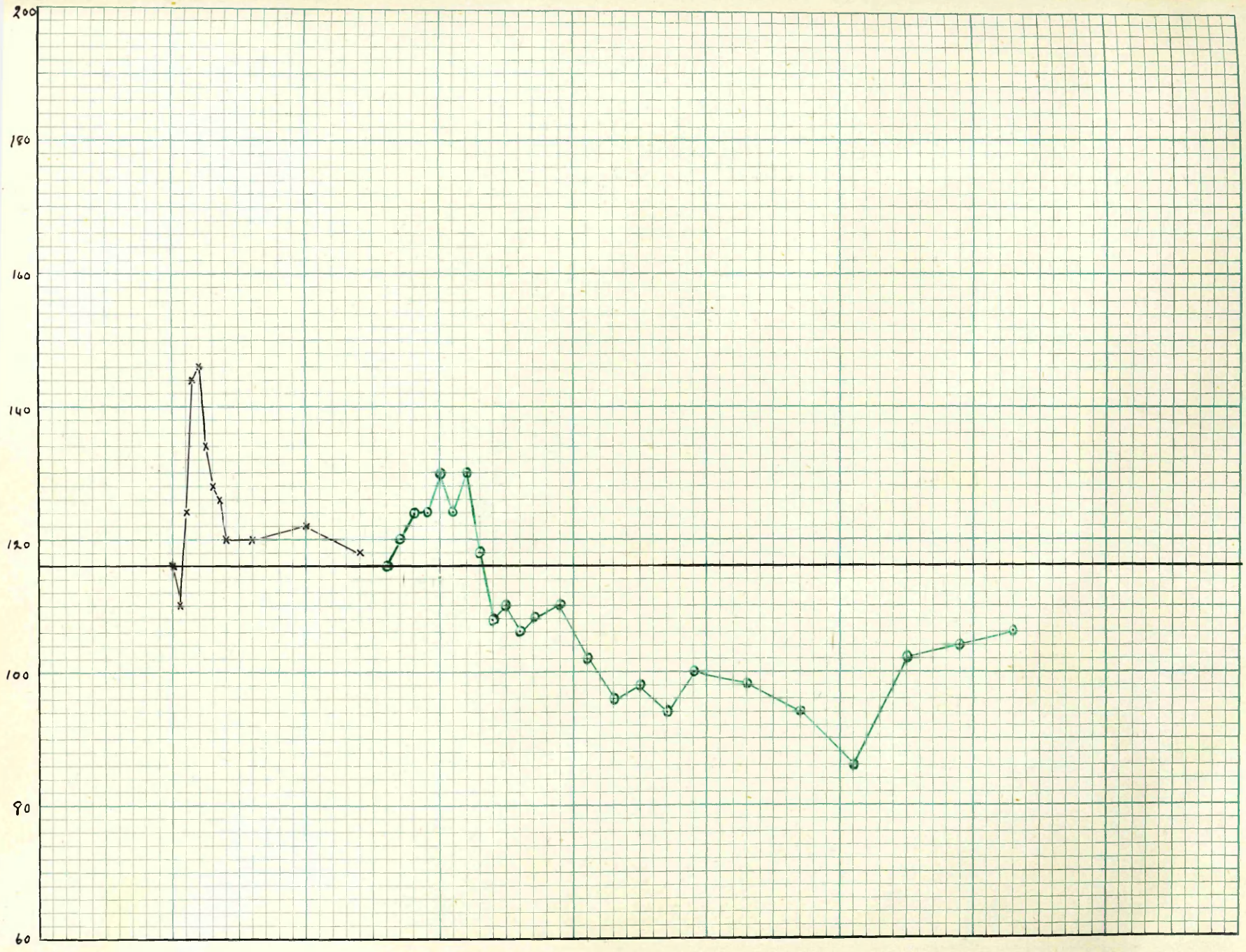
80

1650 BAKER J G. DAY 0


200
180
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60

SCHIZOPHRENICS TESTED AFTER ONE DAY INTERVAL.

~~1011~~
1061

BOWLES. W


DAY 1
220
200
180
160
140
120
100
80
ADRENALINE
0
5
10
15
20
25
30
35
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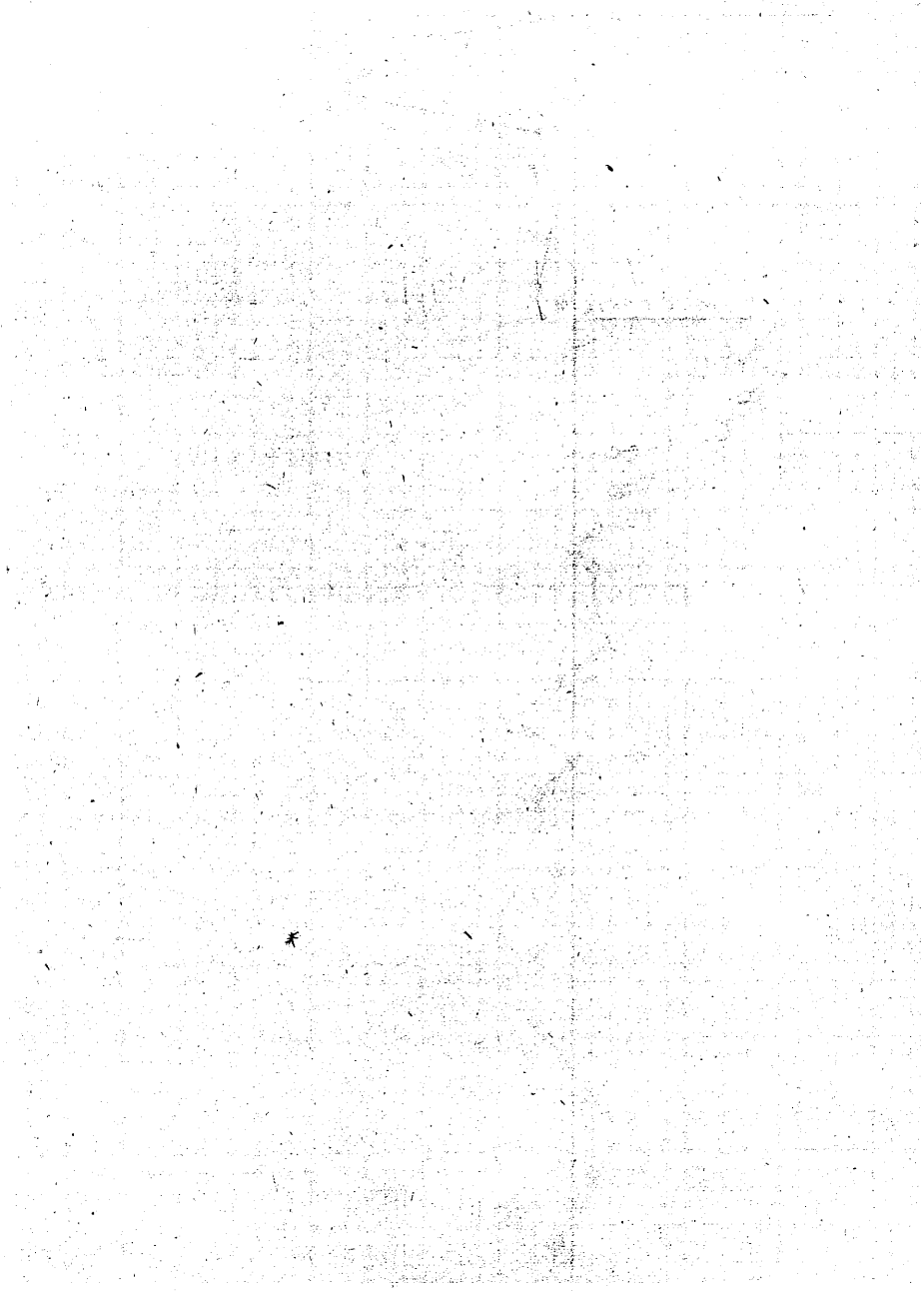
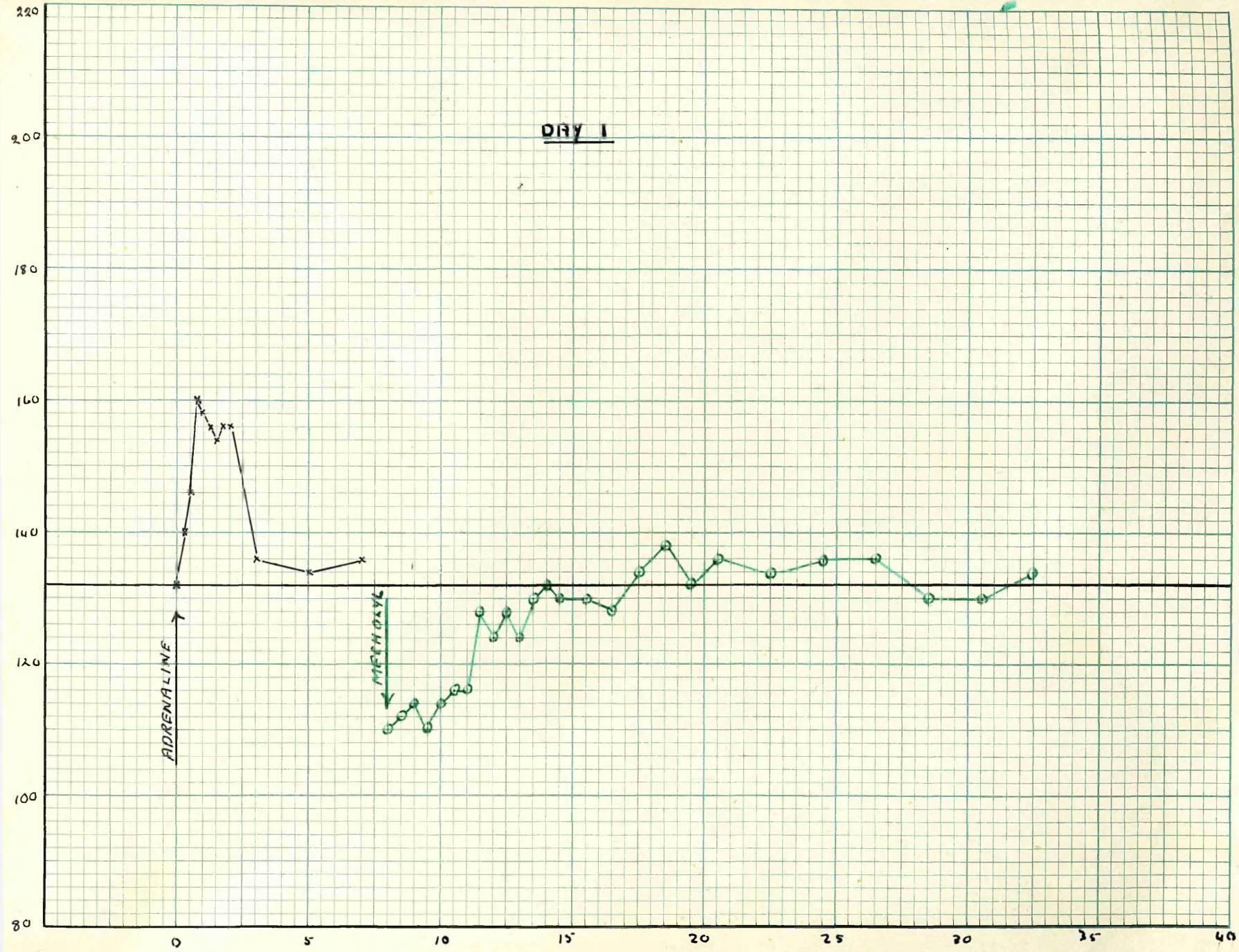
~~1021~~
1081

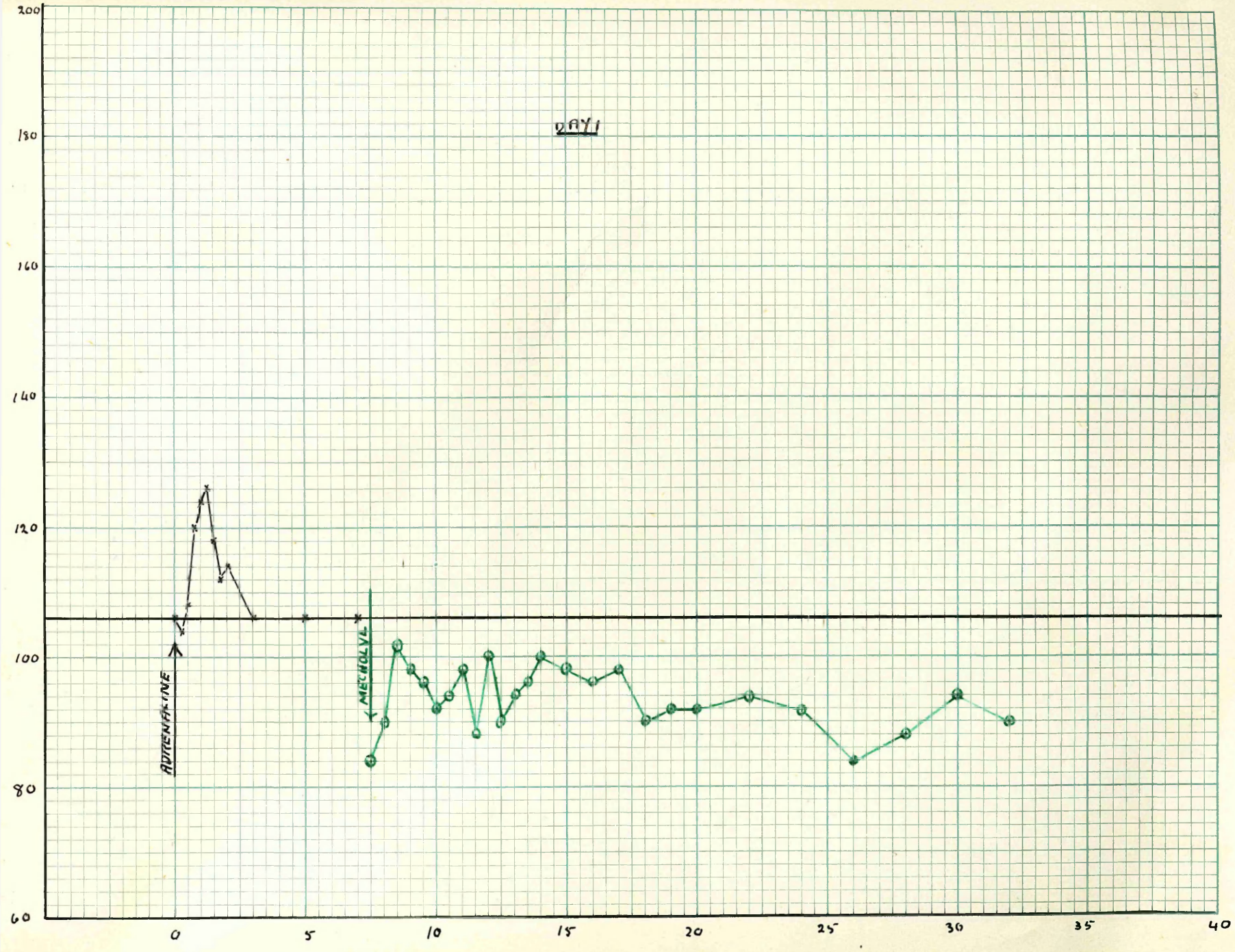
BACON HA.




DAY 1
220
200
180
160
140
120
100
80
0
5
10
15
20
25
30
35
40
ADRENALINE
METHADONE

~~1031~~
1111

LEEK.


200
180
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100
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35
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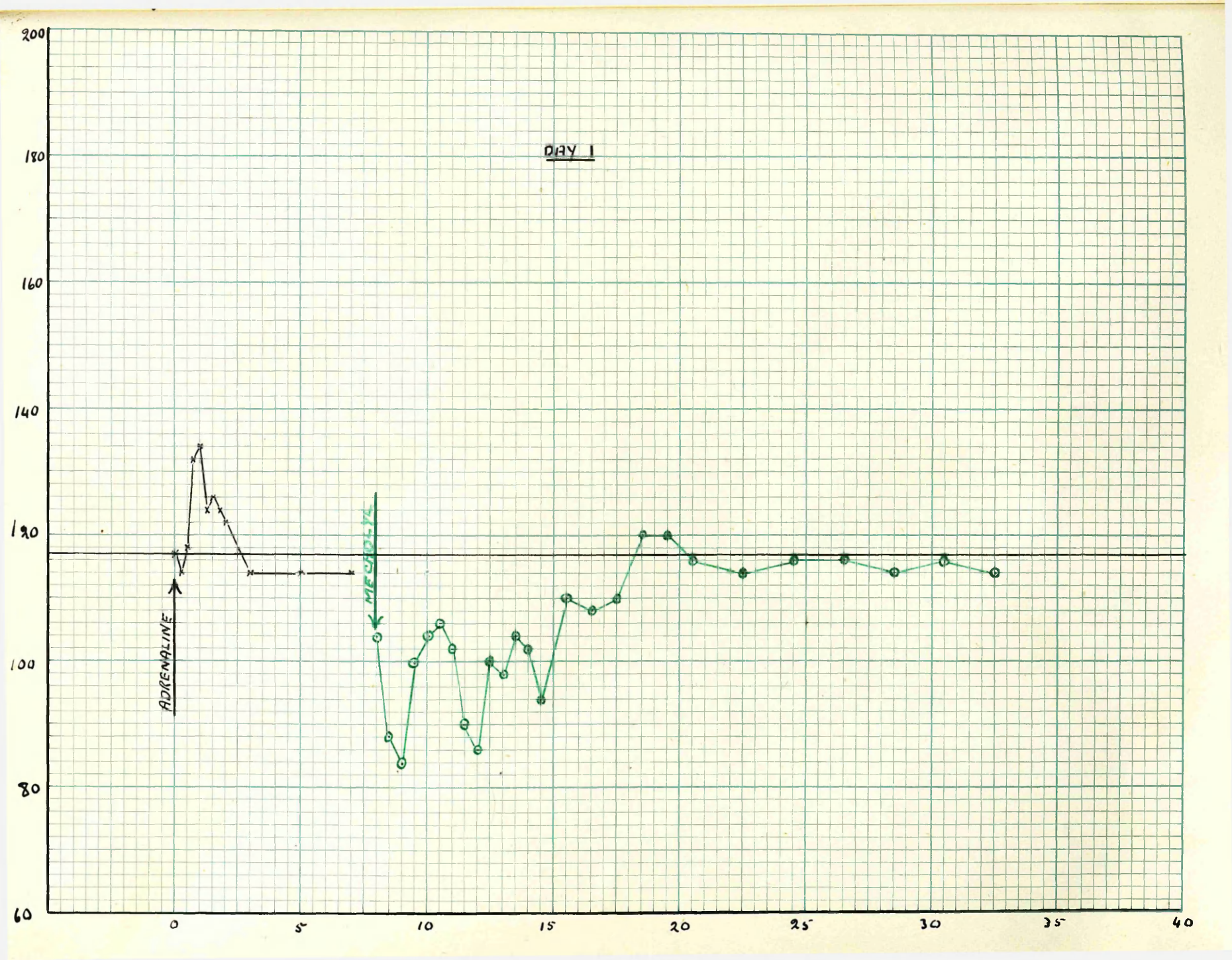
ADRENALINE
METHOLYL

~~1041~~
1131

BEDINGHAM. W


DAY 1
200
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120
100
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60
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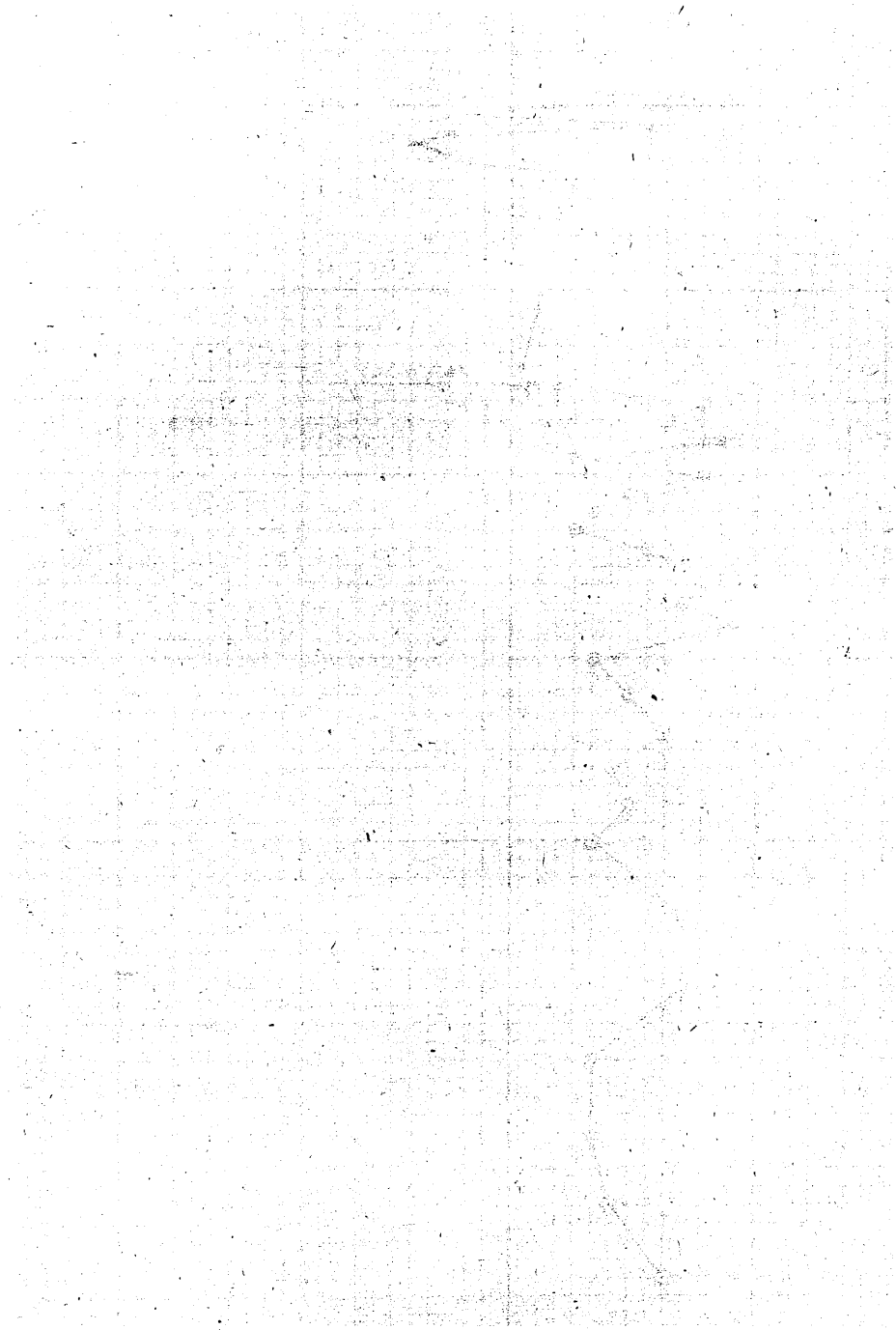
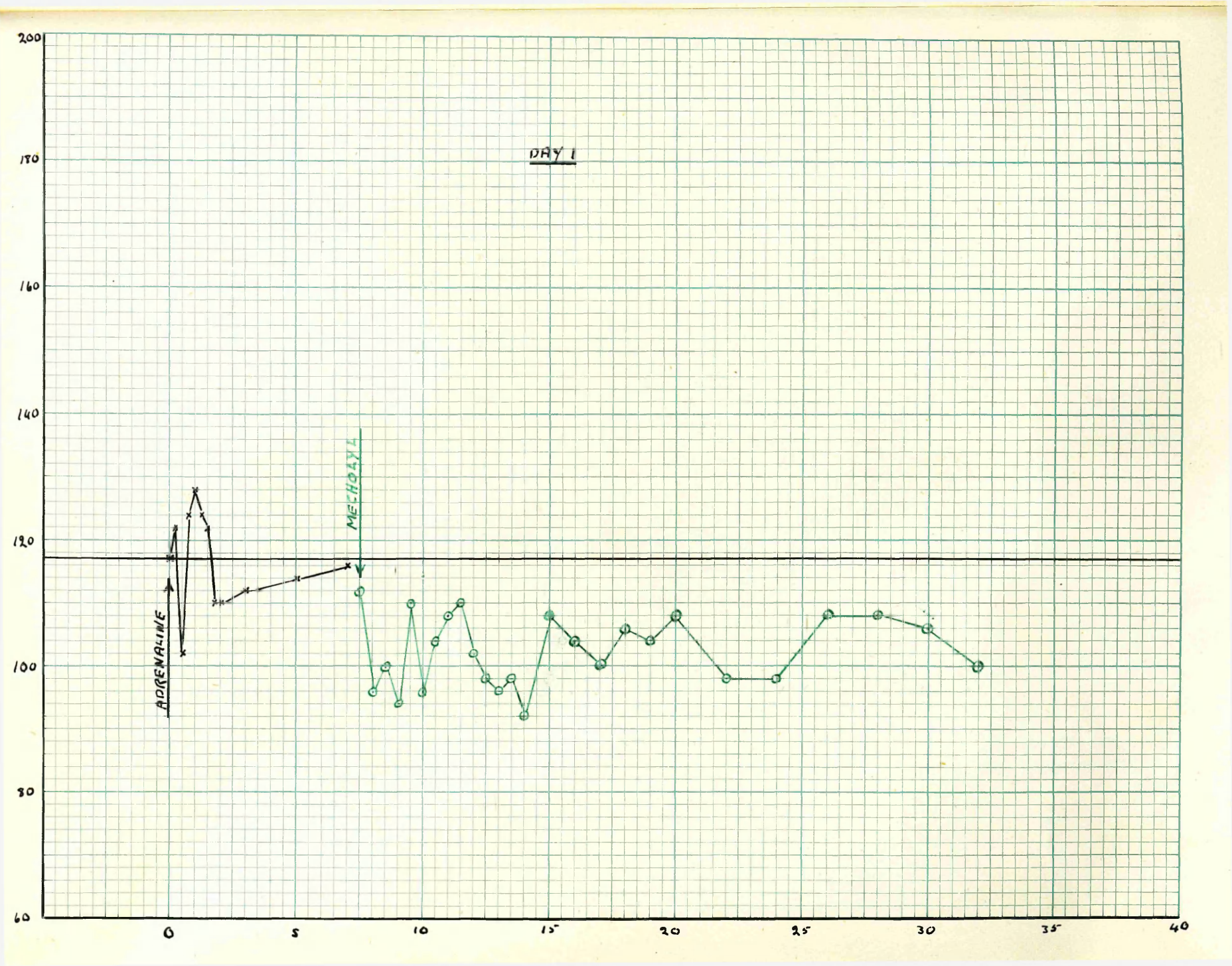
5
10
15
20
25
30
35
40
ADRENALINE
MECHOD-74

~~1051~~ BURN CG

1141




DAY 1
ADRENALINE
METHOXAMINE
200
180
160
140
120
100
80
60
0
5
10
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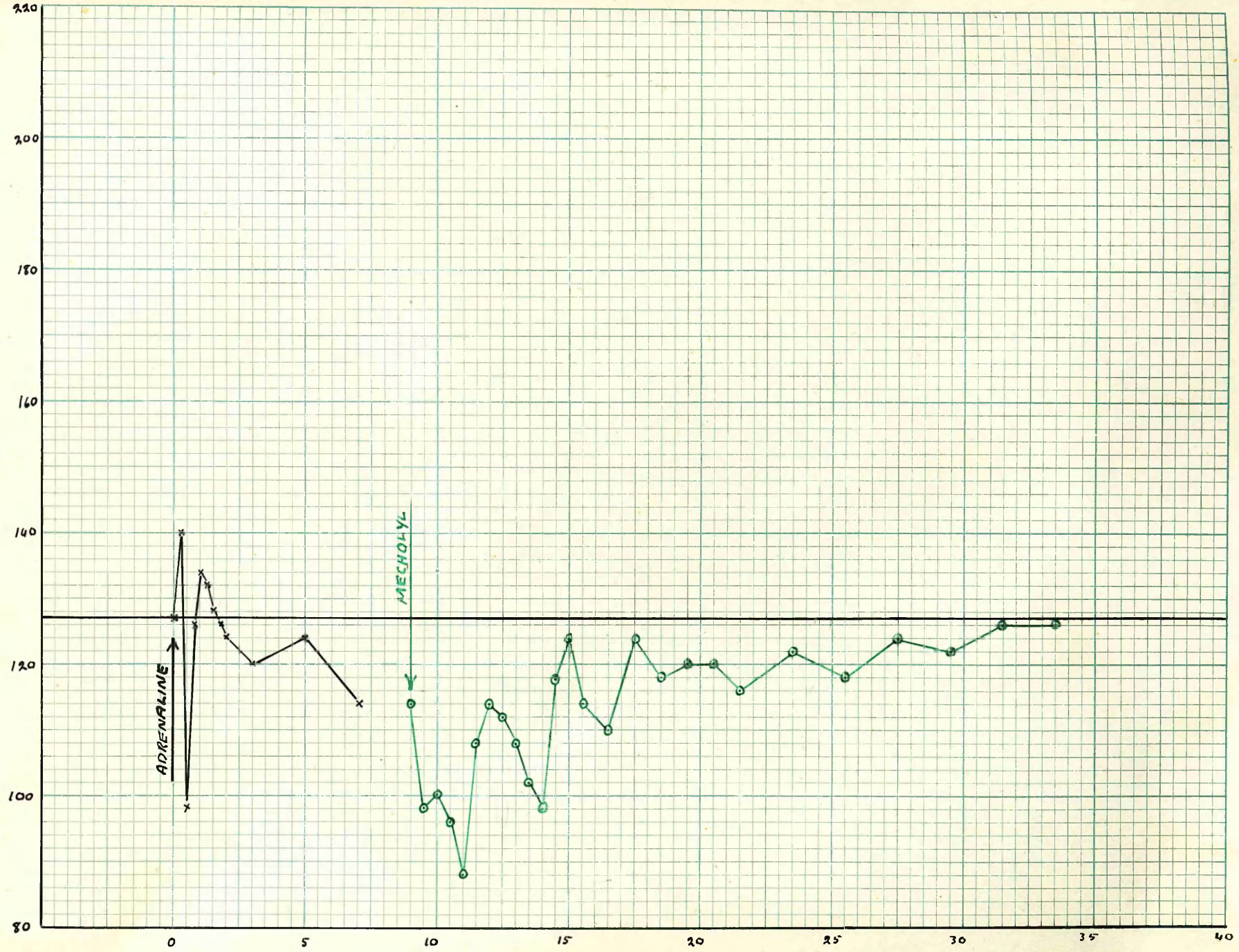
20
25
30
35
40

~~1041~~ 1151. MORE G.L DAY 1


220
200
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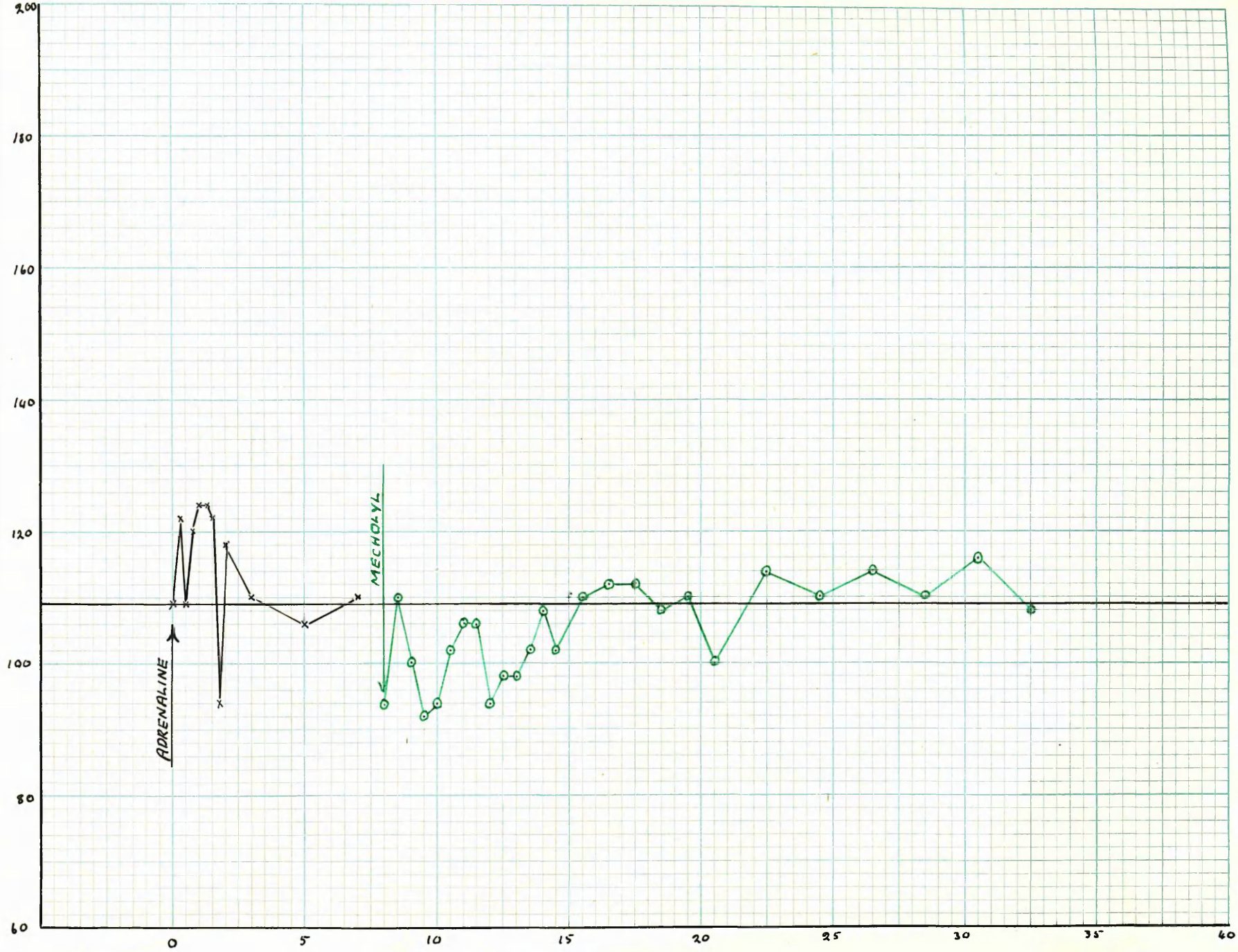
35
40
ADRENALINE
MECHOLYL

MITCHELL KE DAY 1


200
180
160
140
120
100
80
60
ADRENALINE
MECHOLYL
0
5
10
15
20
25
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35
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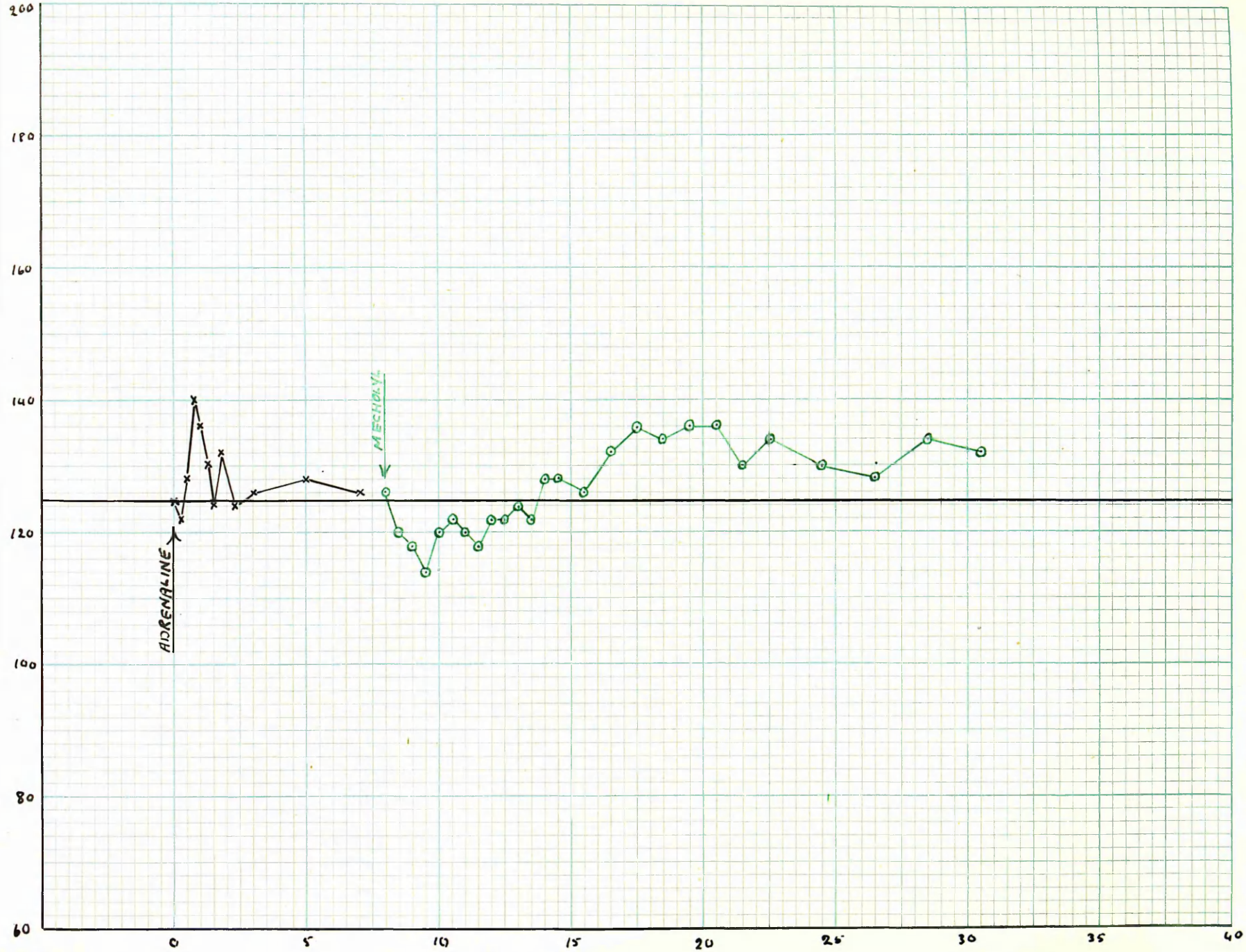
~~1081~~
1201

WILSON L. DAY 1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ADRENALINE
MECHOLYL
0
5
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15
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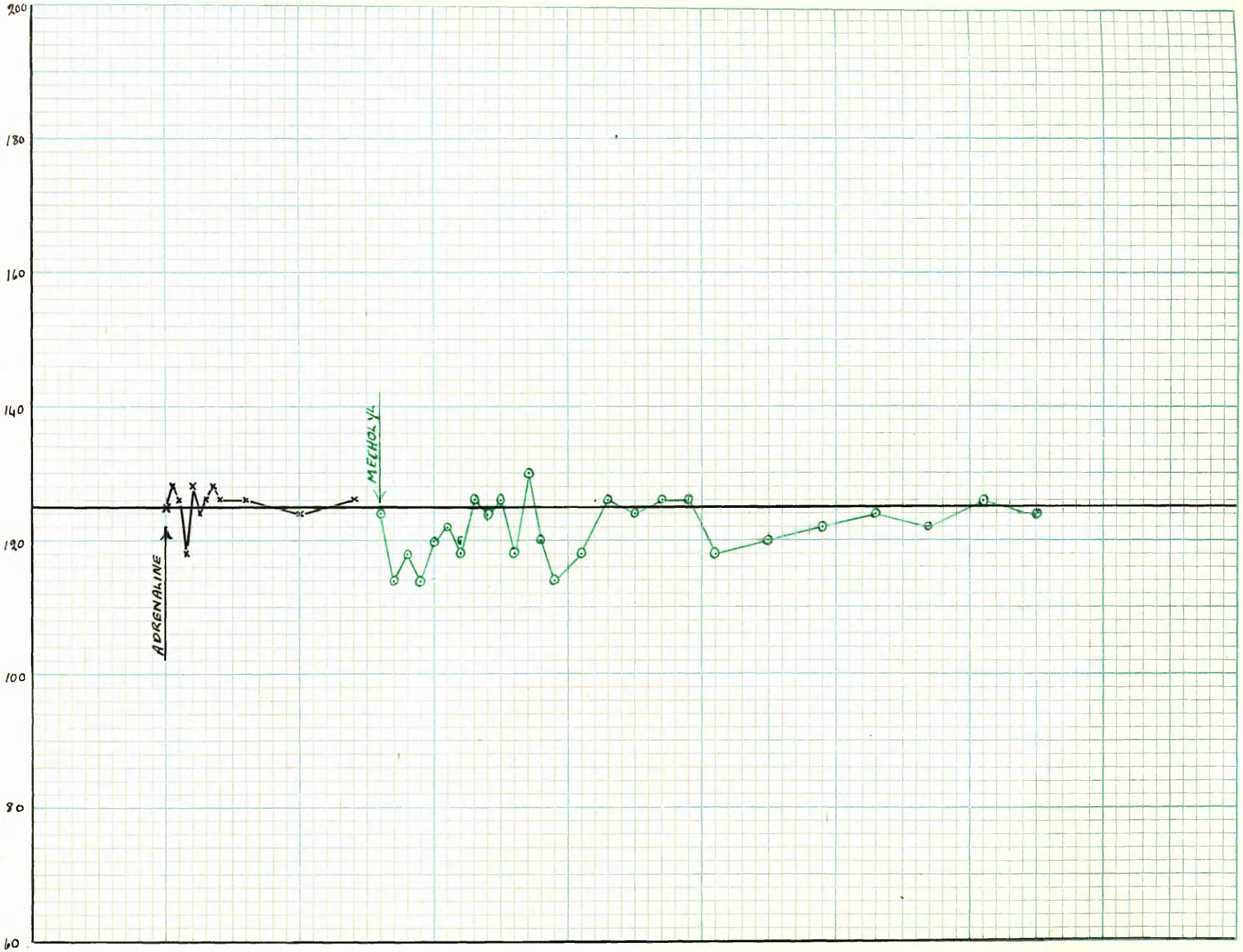
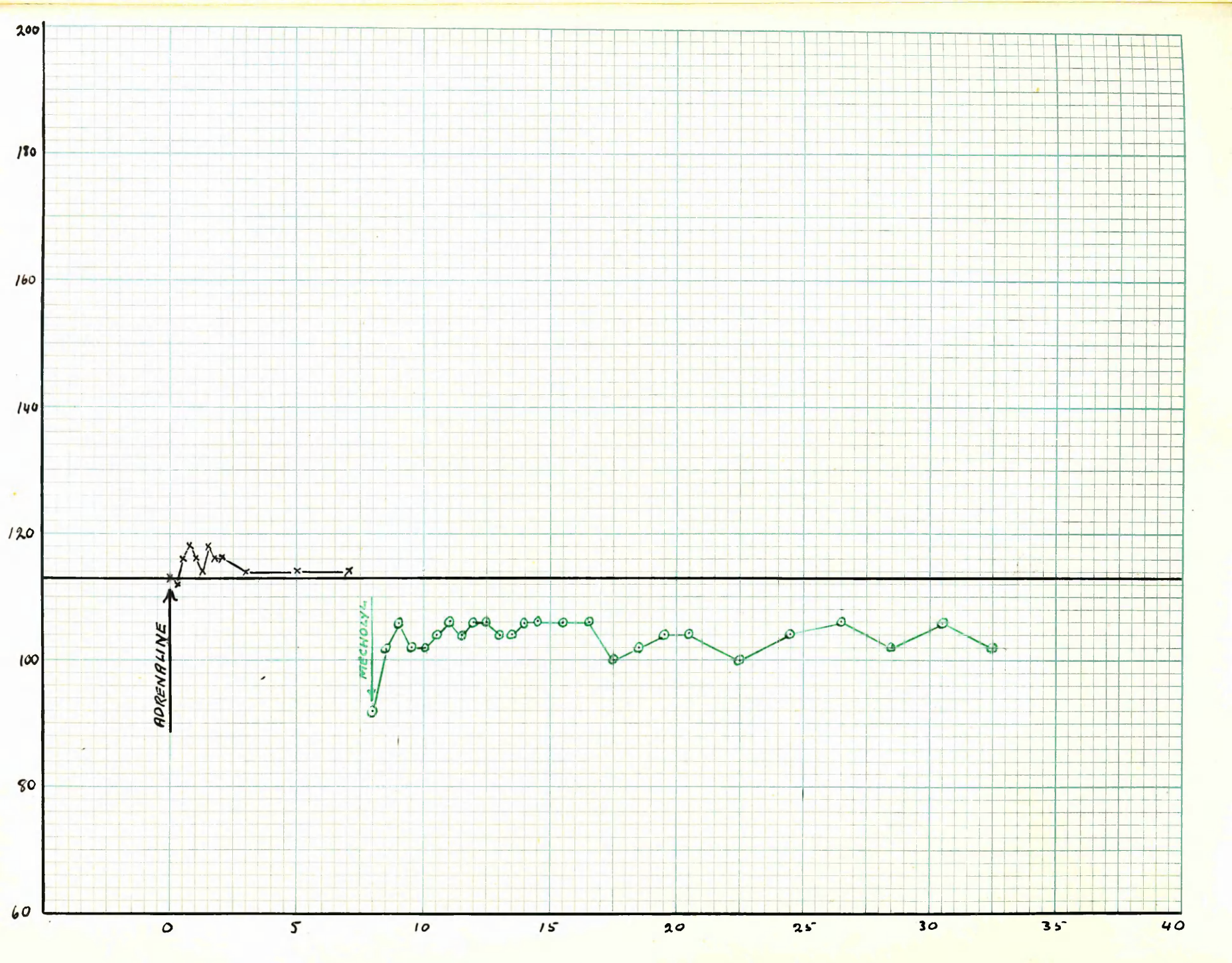

200
180
160
140
120
100
80
60
ADRENALINE
MECHOLYL

HHH. HALL RE DAY

1231


200
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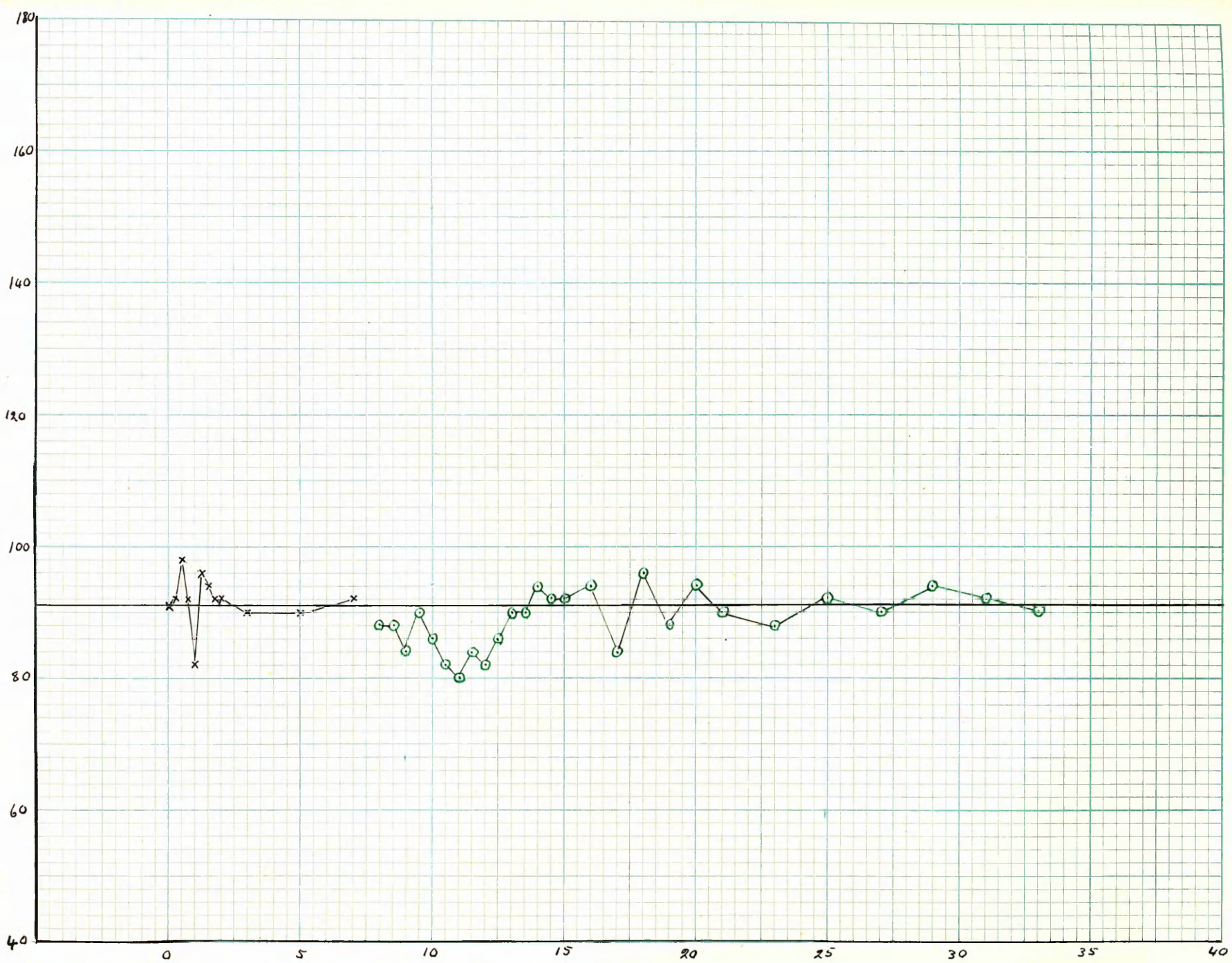
40
ADRENALINE
MECHOLYL

1281 BELLWOOD R DAY 1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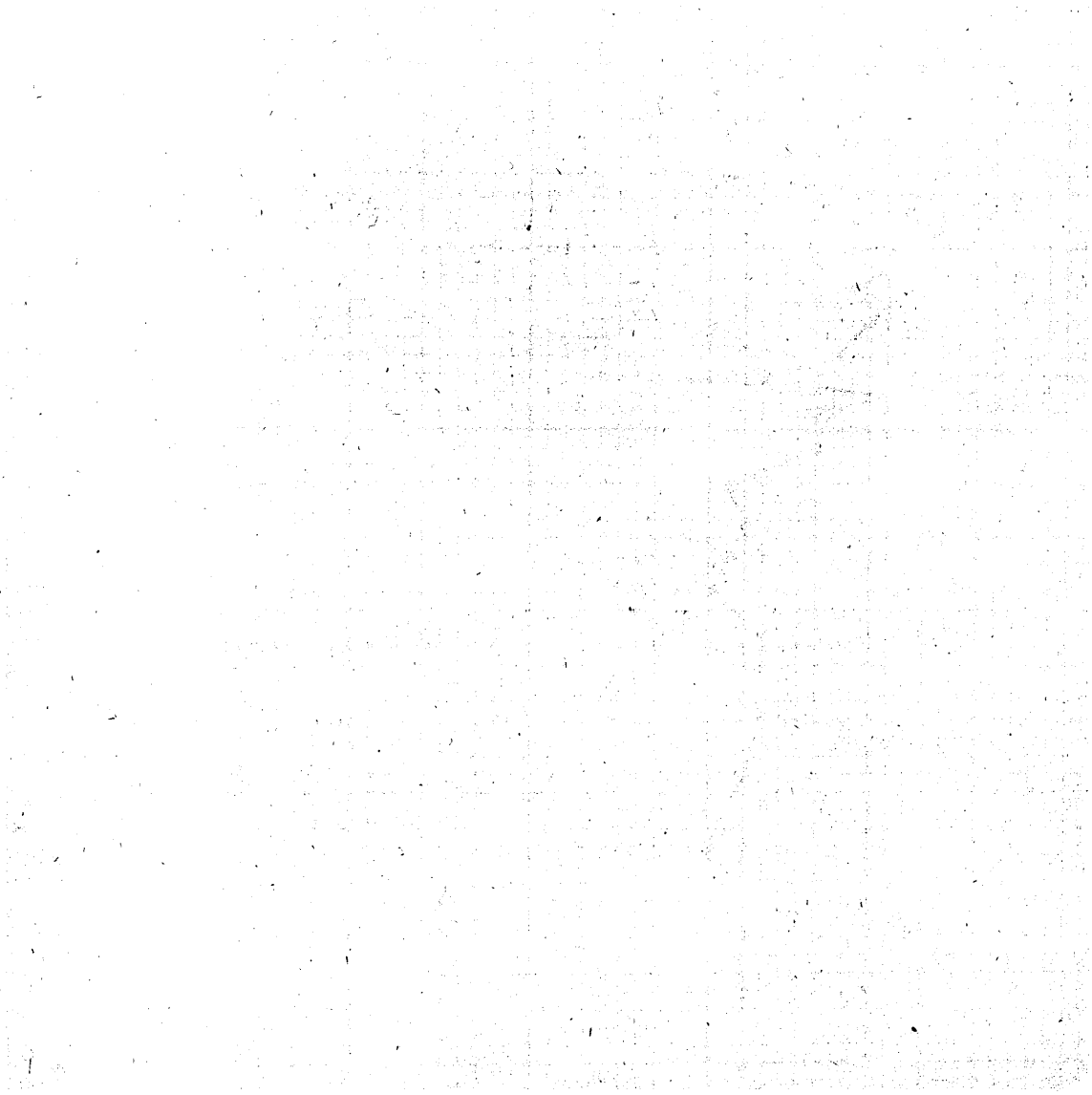

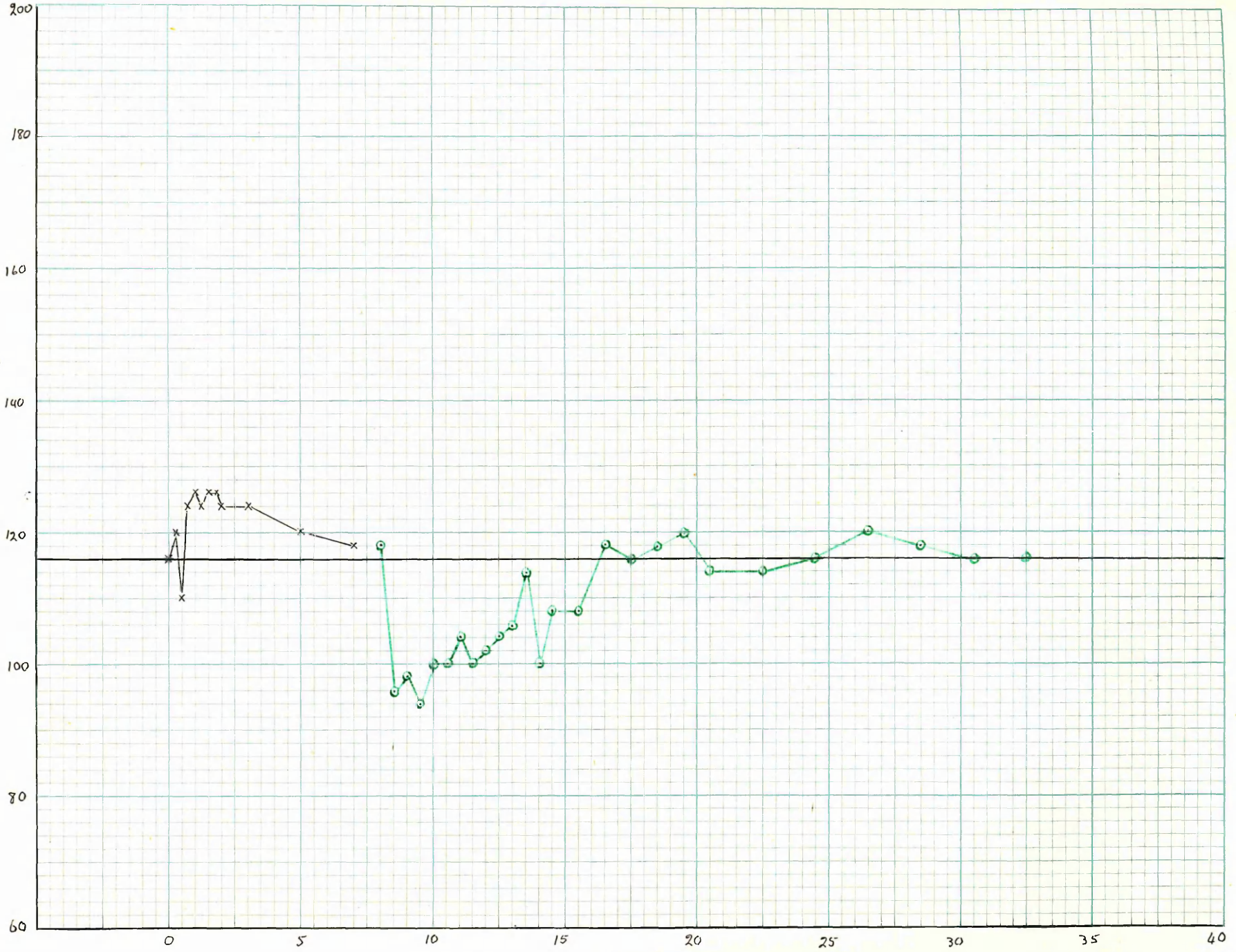
200
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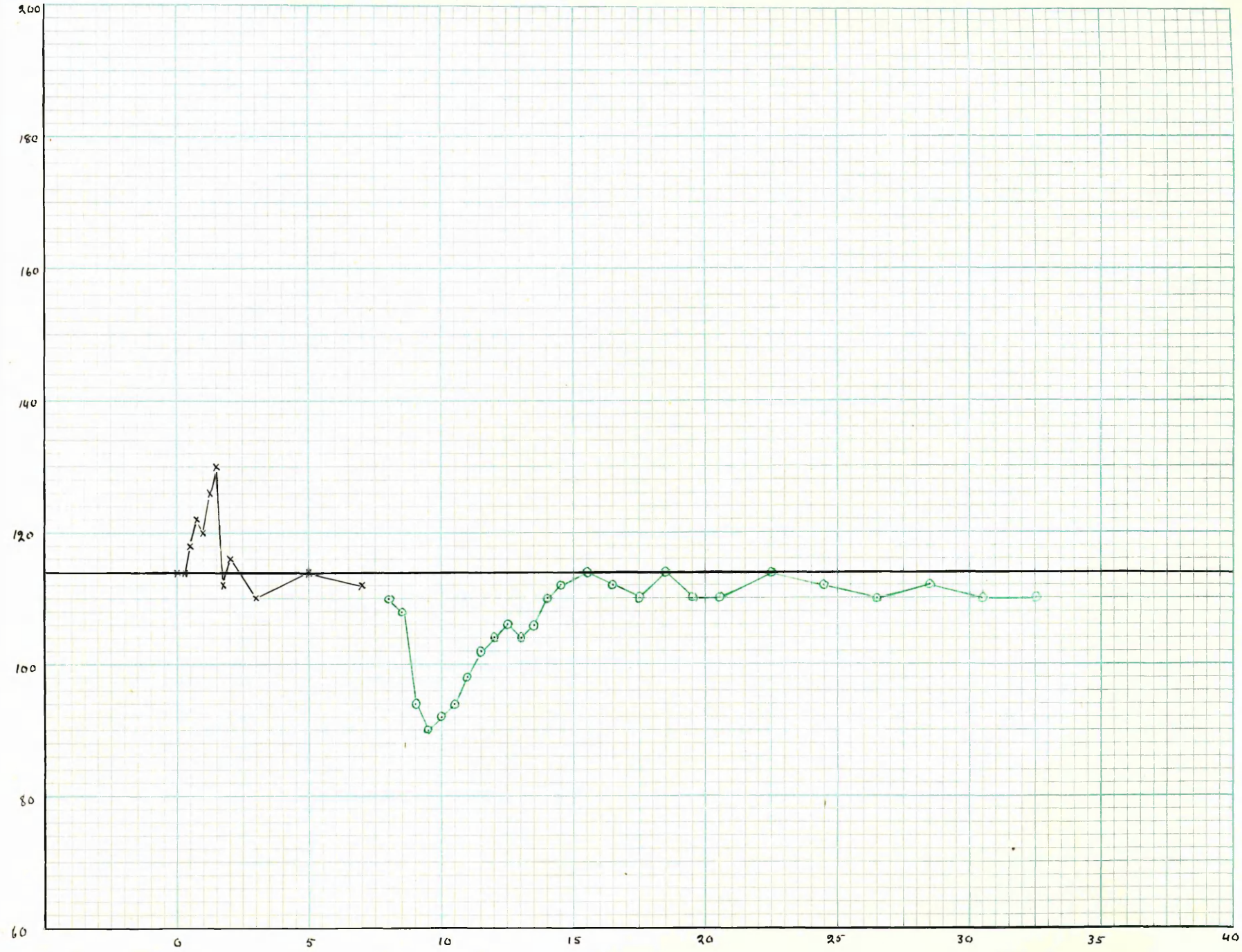
~~HGT~~

DIXON GB DAY 1

1331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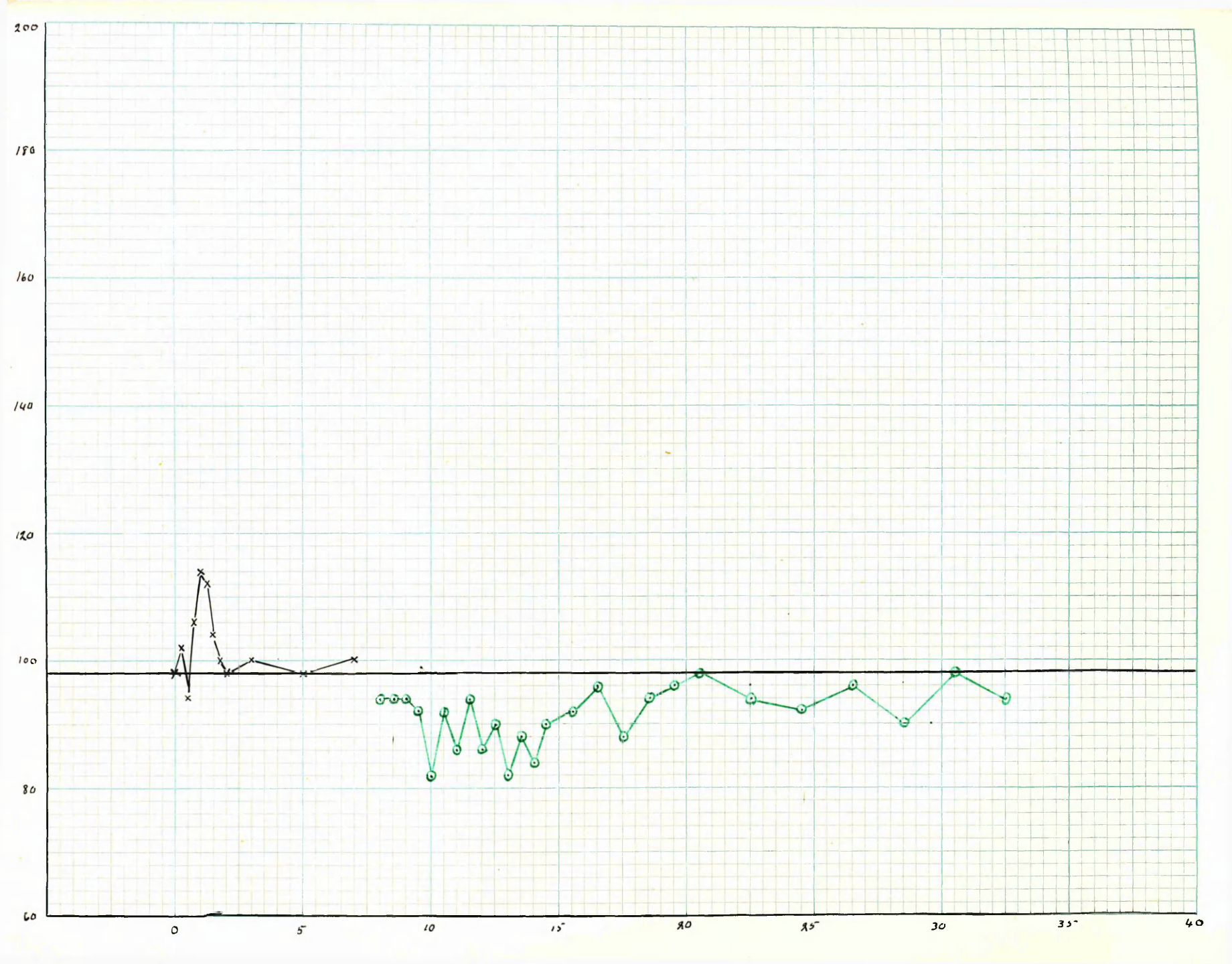
#54

1351

COALESTON EA DAY 1


200
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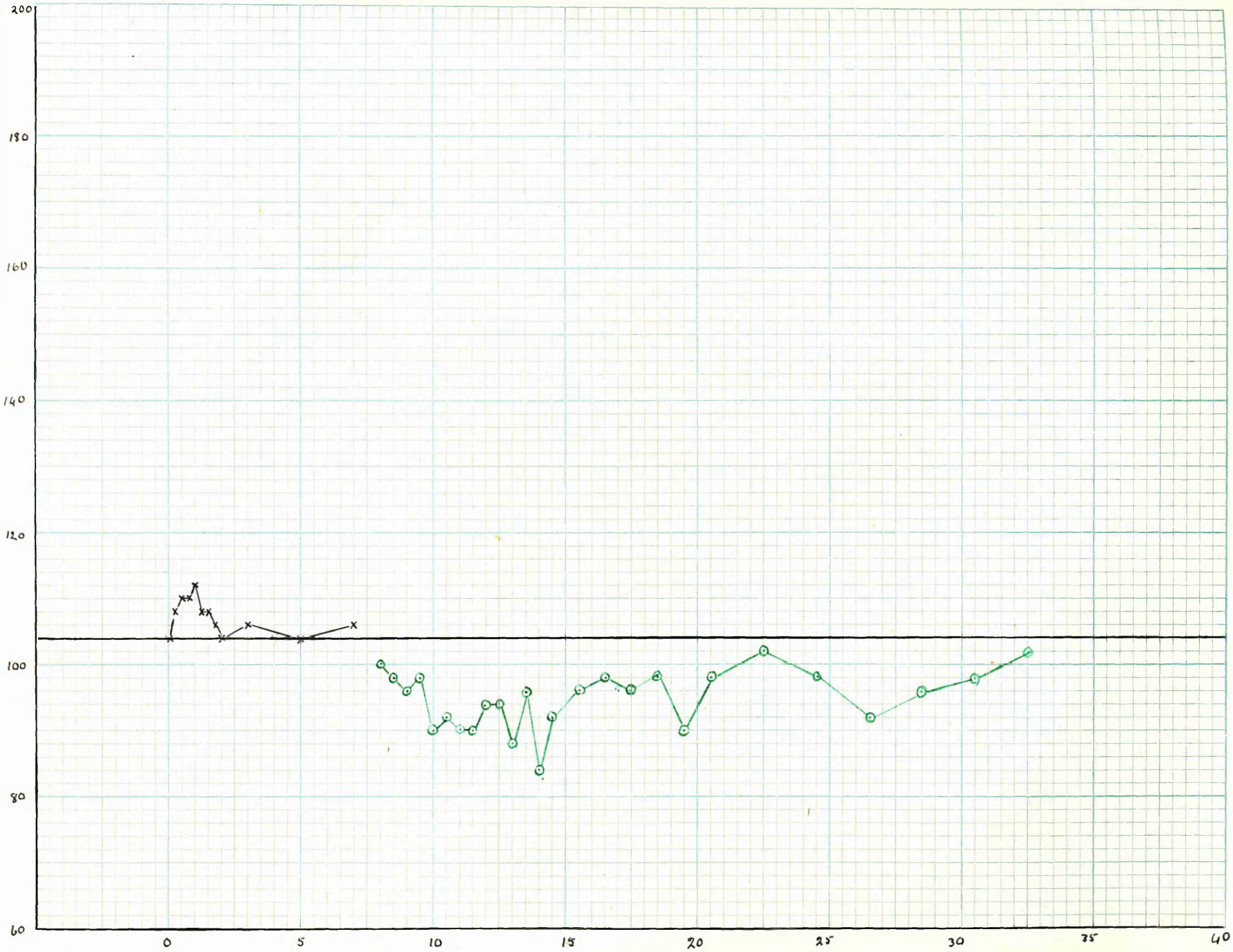
~~HOI~~ BROGDEN K DAY 1

1401


200
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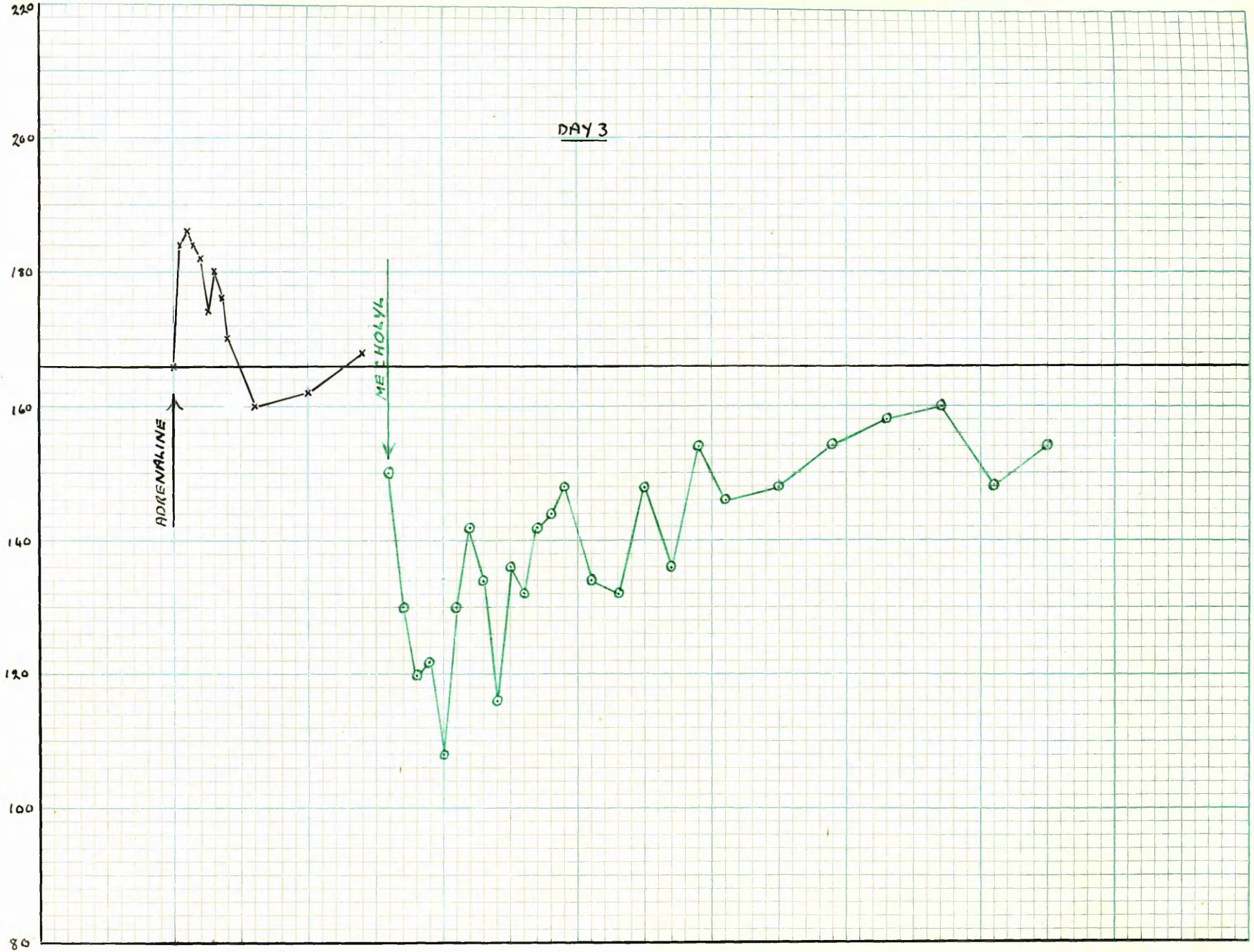
SCHIZOPHRENICS TESTED AFTER A THREE-DAY INTERVAL.

~~1012~~

BARASS BP

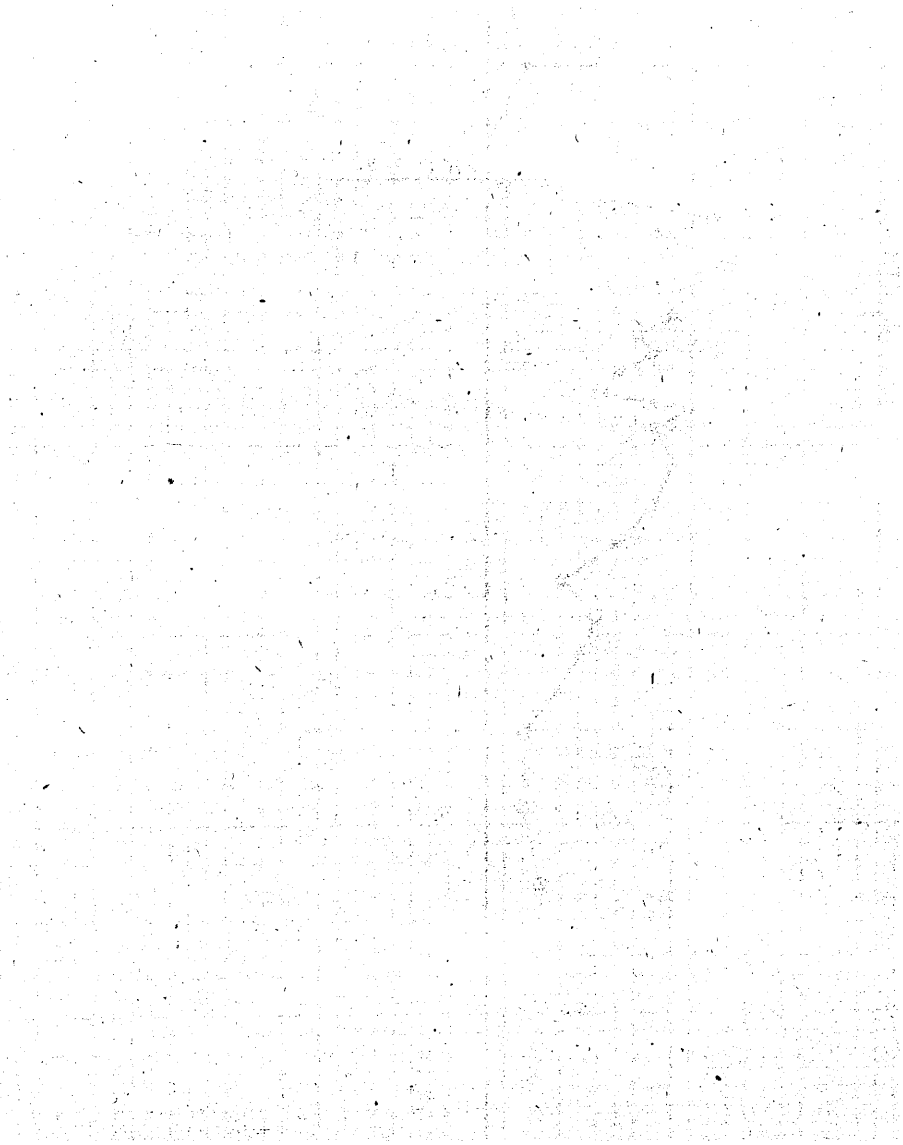
~~1032~~
1042

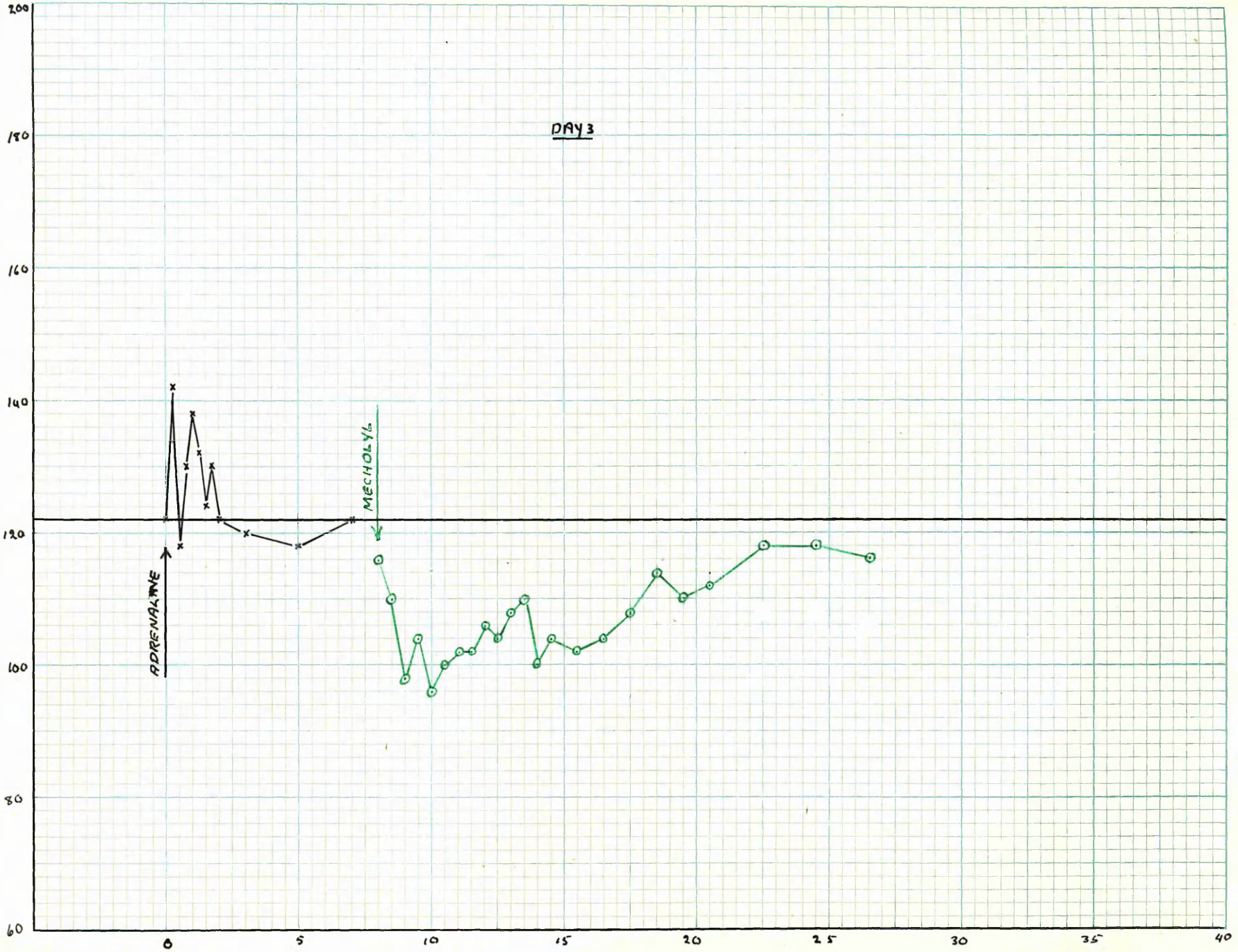

DAY 3
220
200
180
160
140
120
100
80
ADRENALINE
METHOLYL

~~1022~~

1092

DIXON E




DAY 3
ADRENALINE
MECHOLYL
200
180
160
140
120
100
80
60
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5
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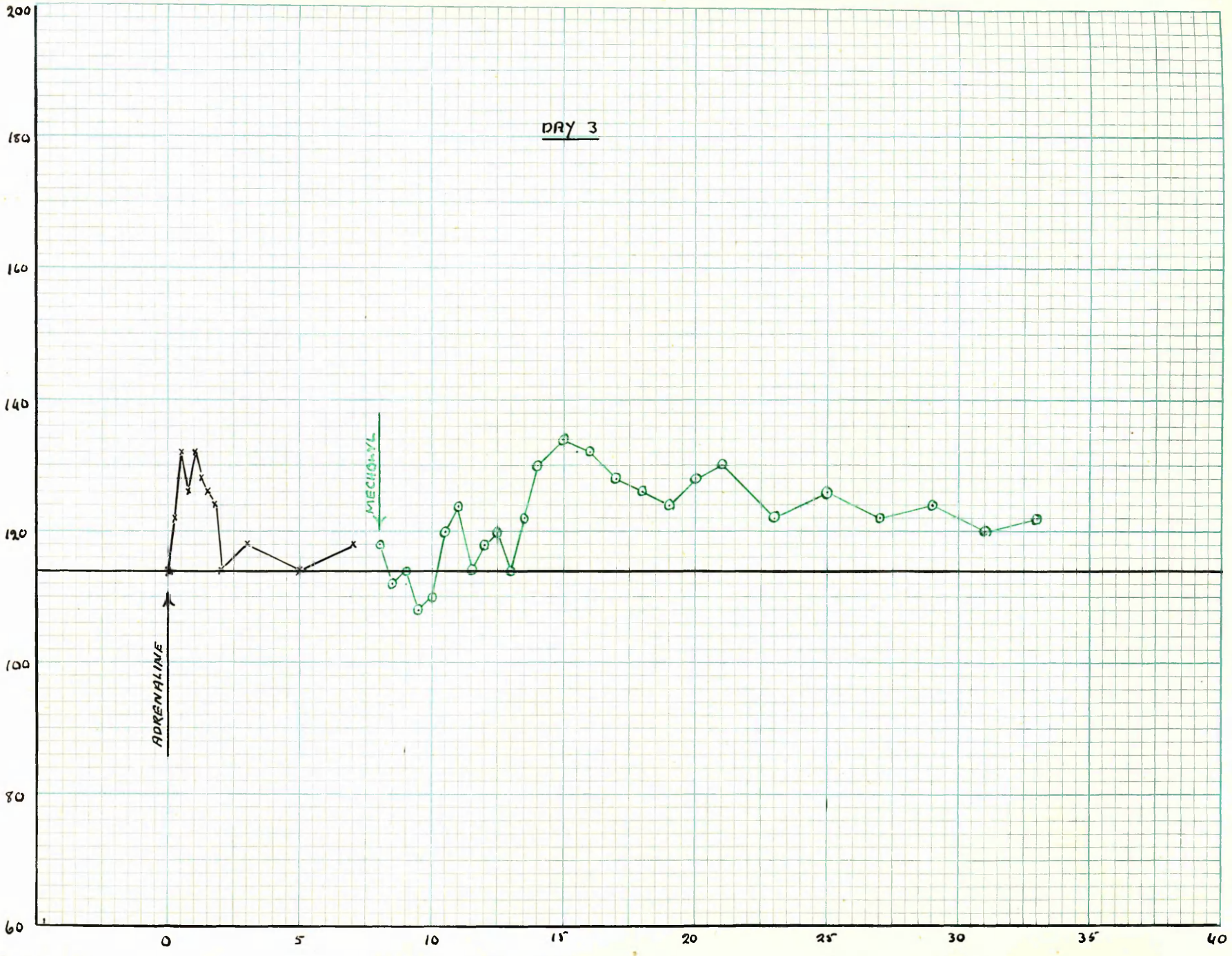
20
25
30
35
40

~~1032~~

1102

REMISSION 5


DAY 3
200
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5
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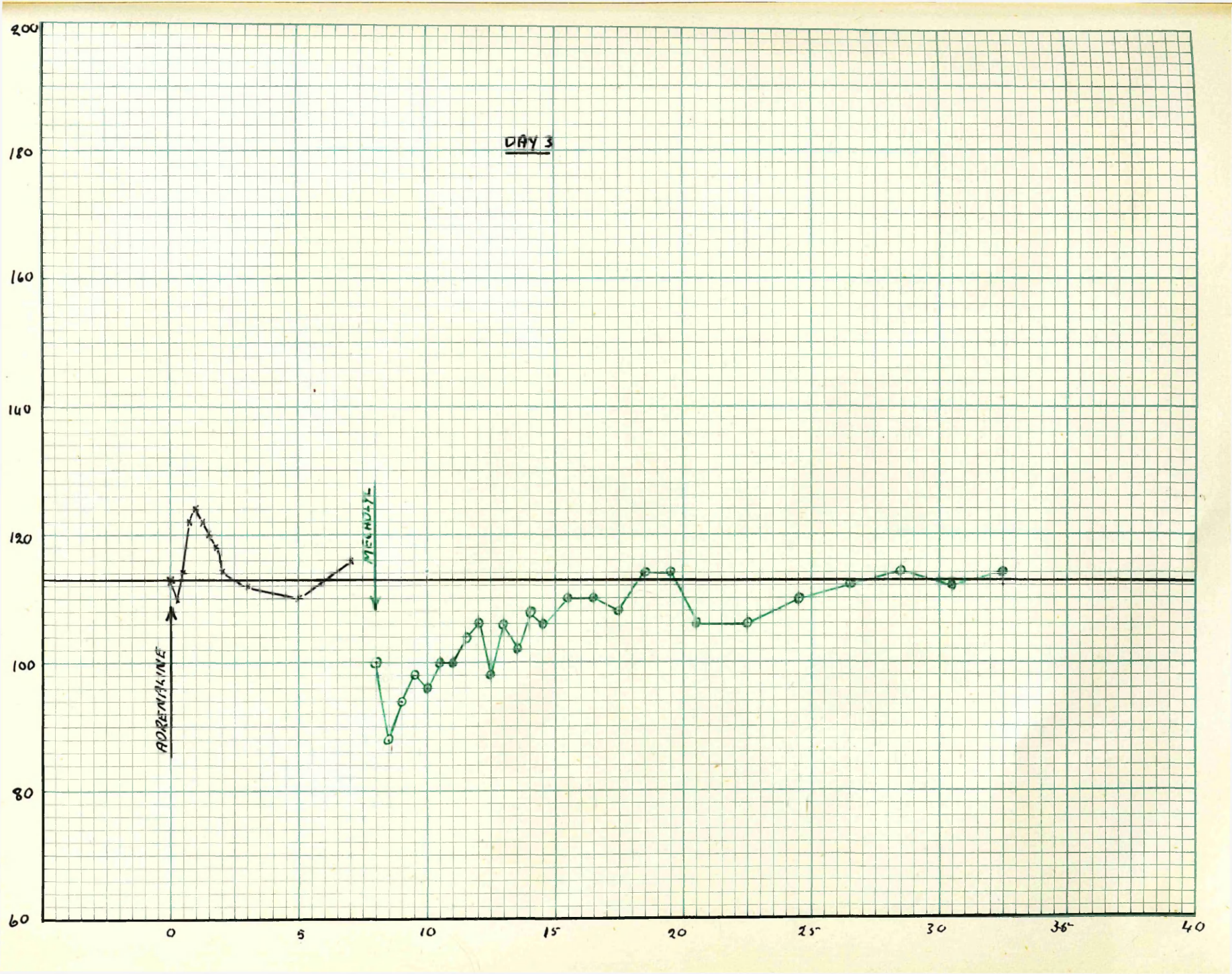
25
30
35
40
ADRENALINE
MECHONYL

~~1042~~ HYNES O

1122


DAY 3
200
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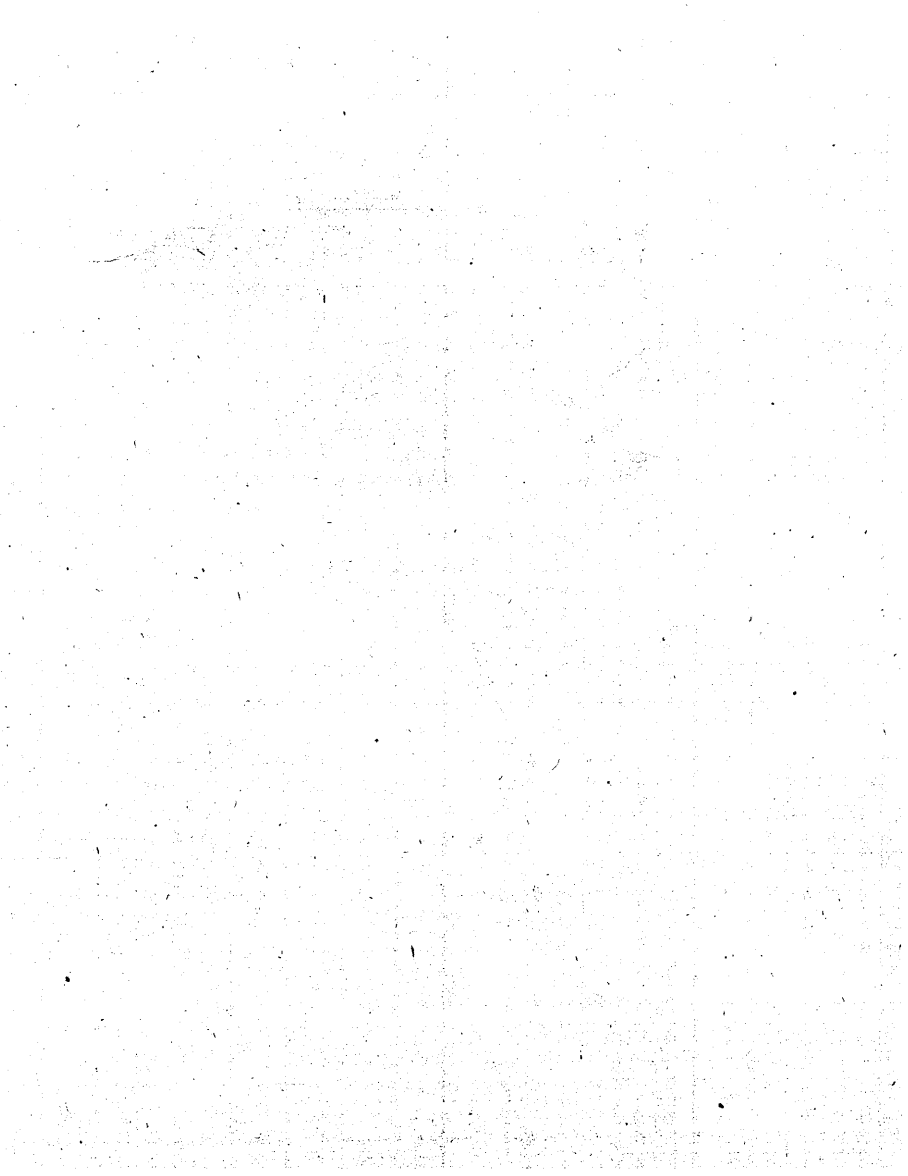
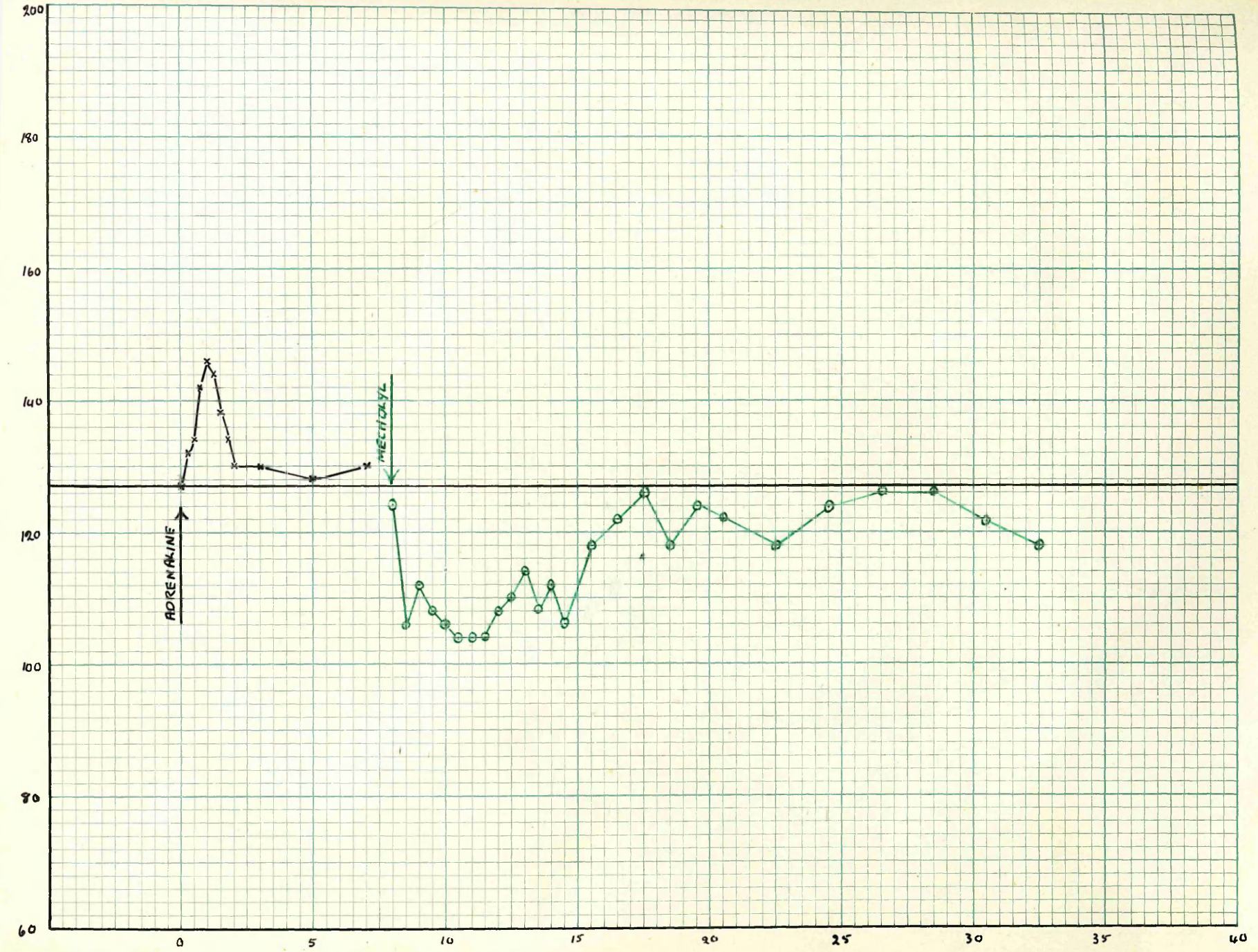
40
ADRENALINE
METHADYL

PEAKE R DAY 14

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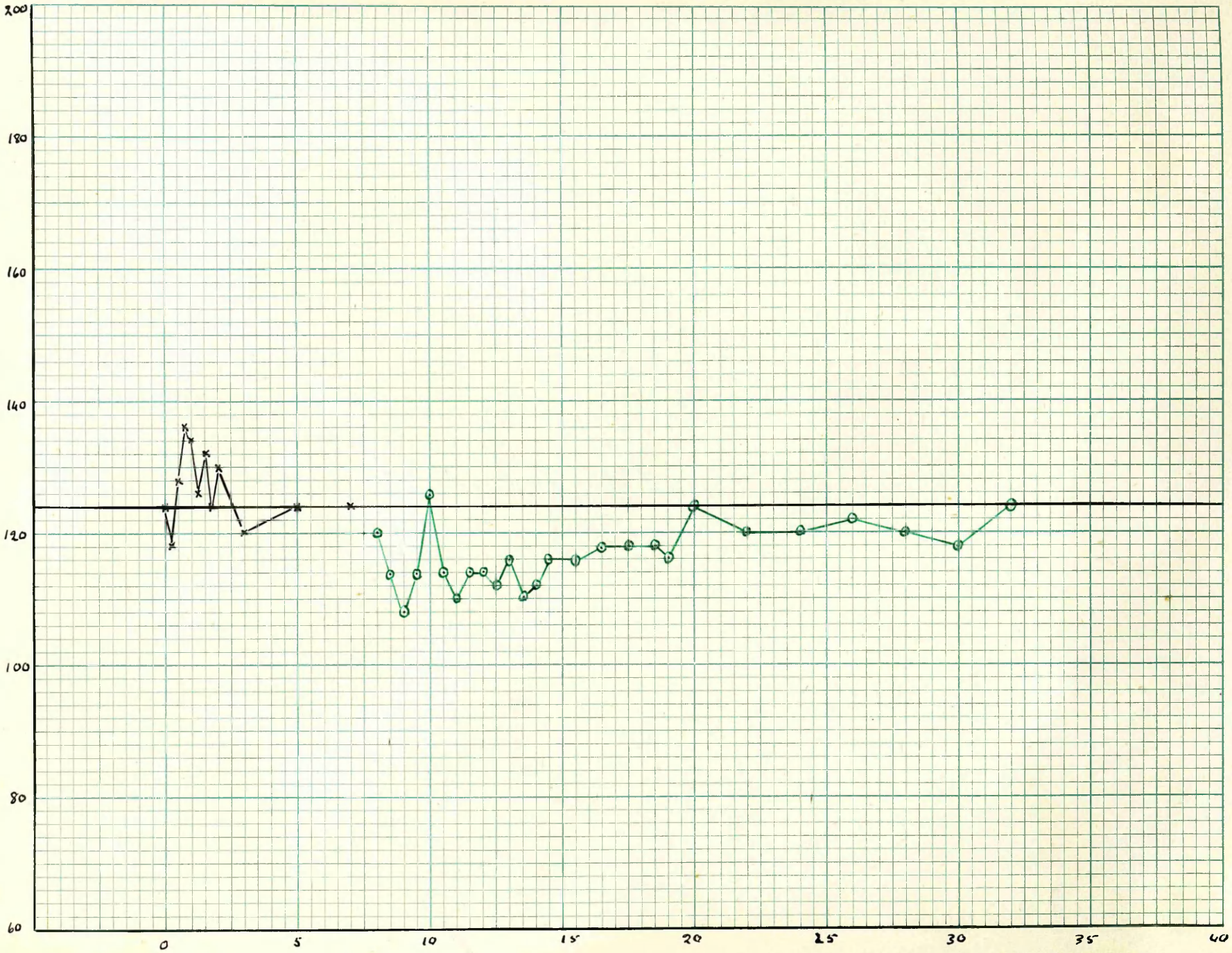
ADRENALINE
MECHOLYL


200
180
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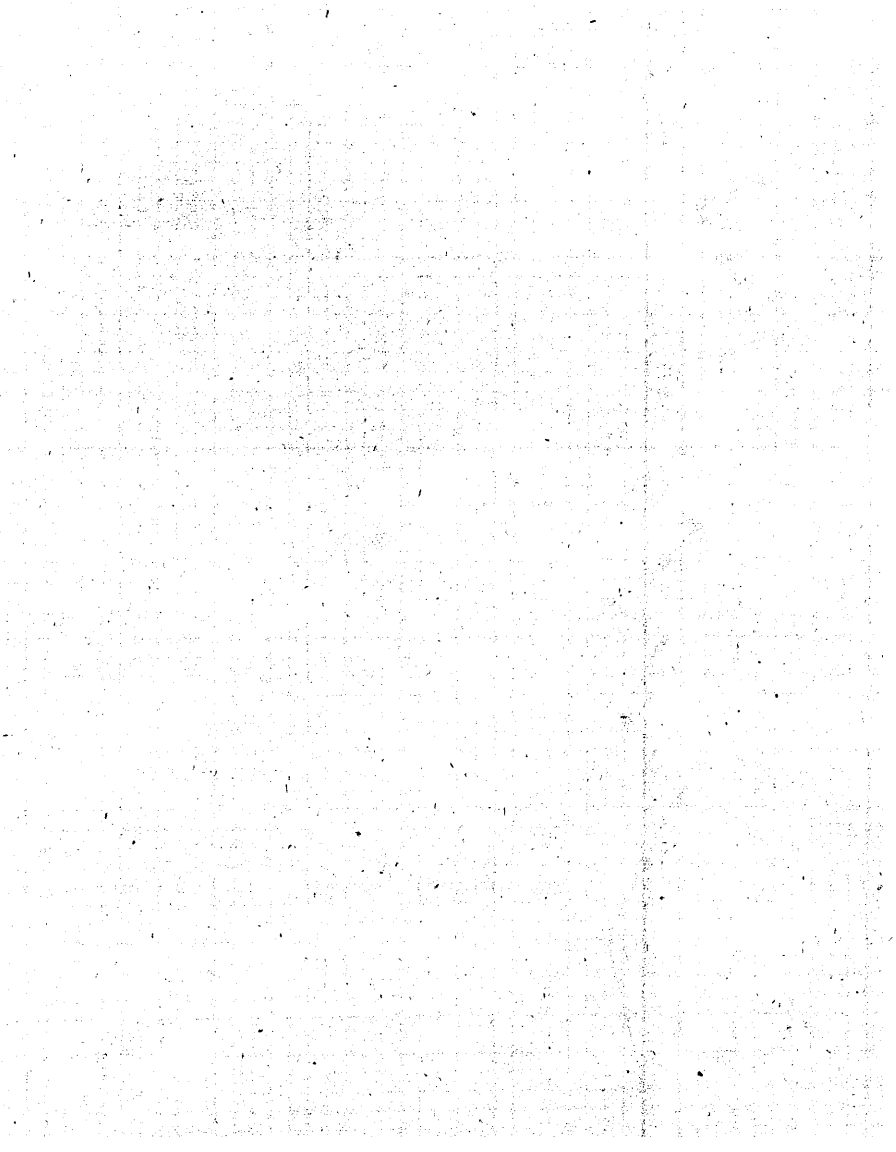
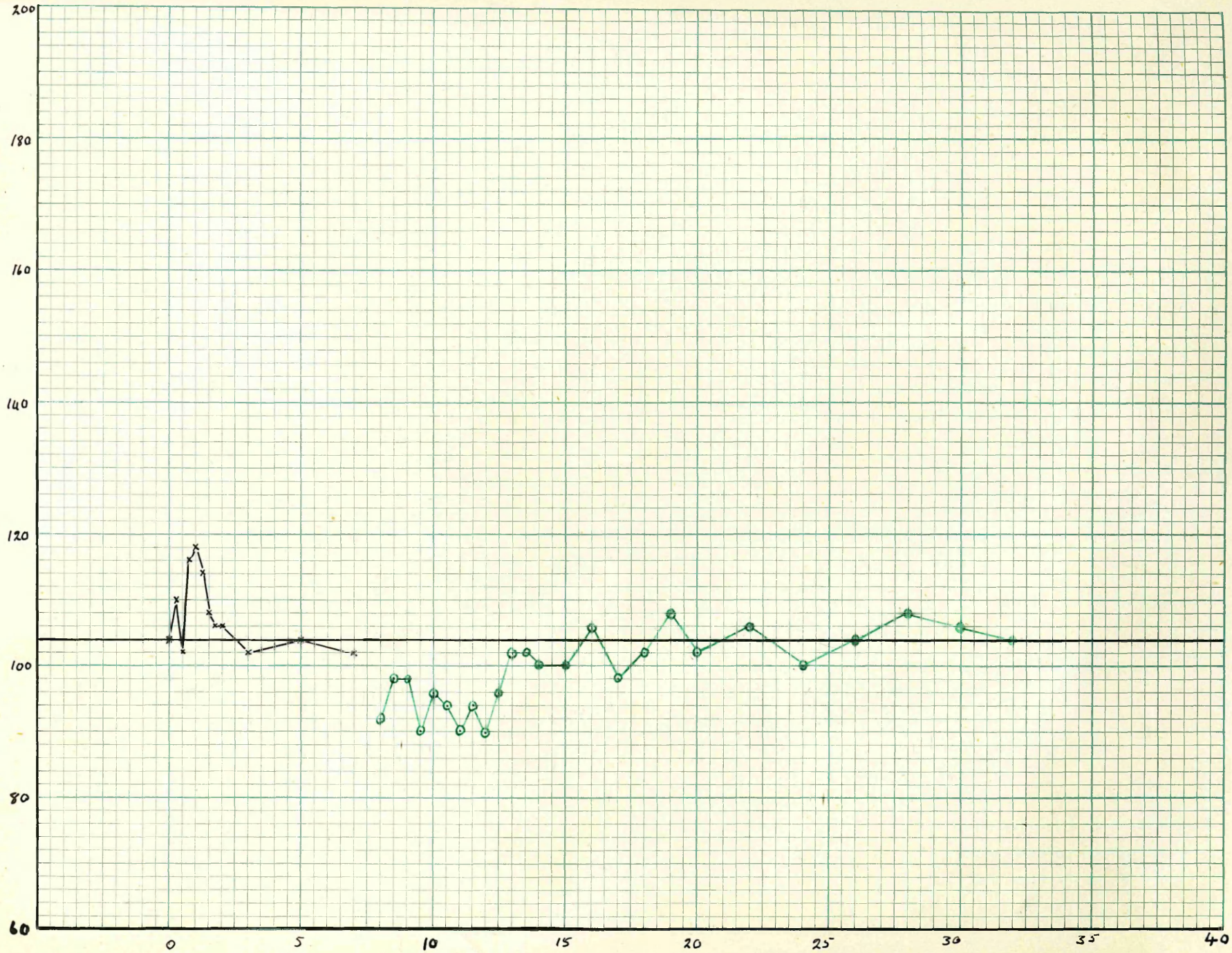
~~1042~~ BRYL H. DAY 3

1252




200
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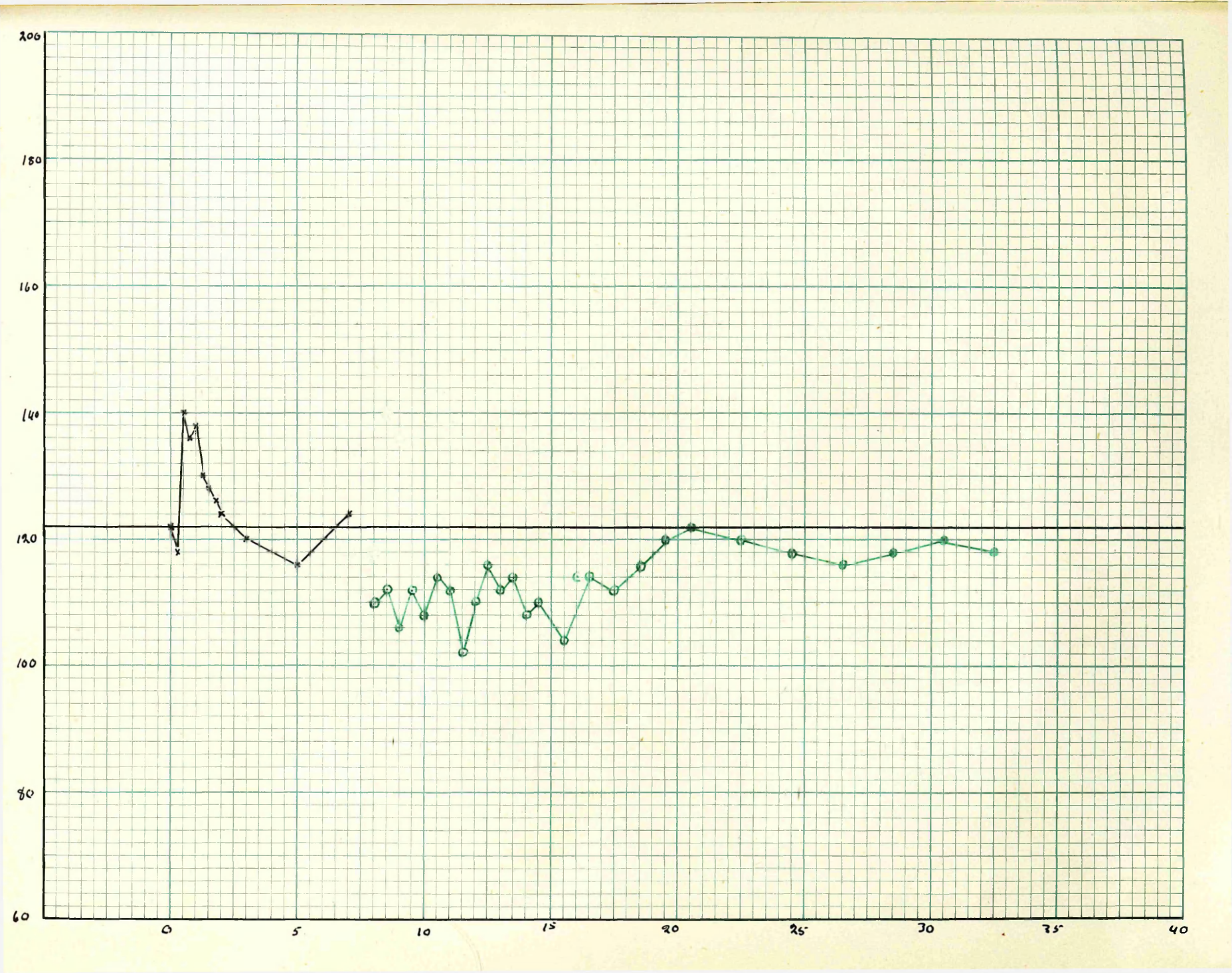
~~1082~~ ELLIS J.W. DAY 3

1262


200
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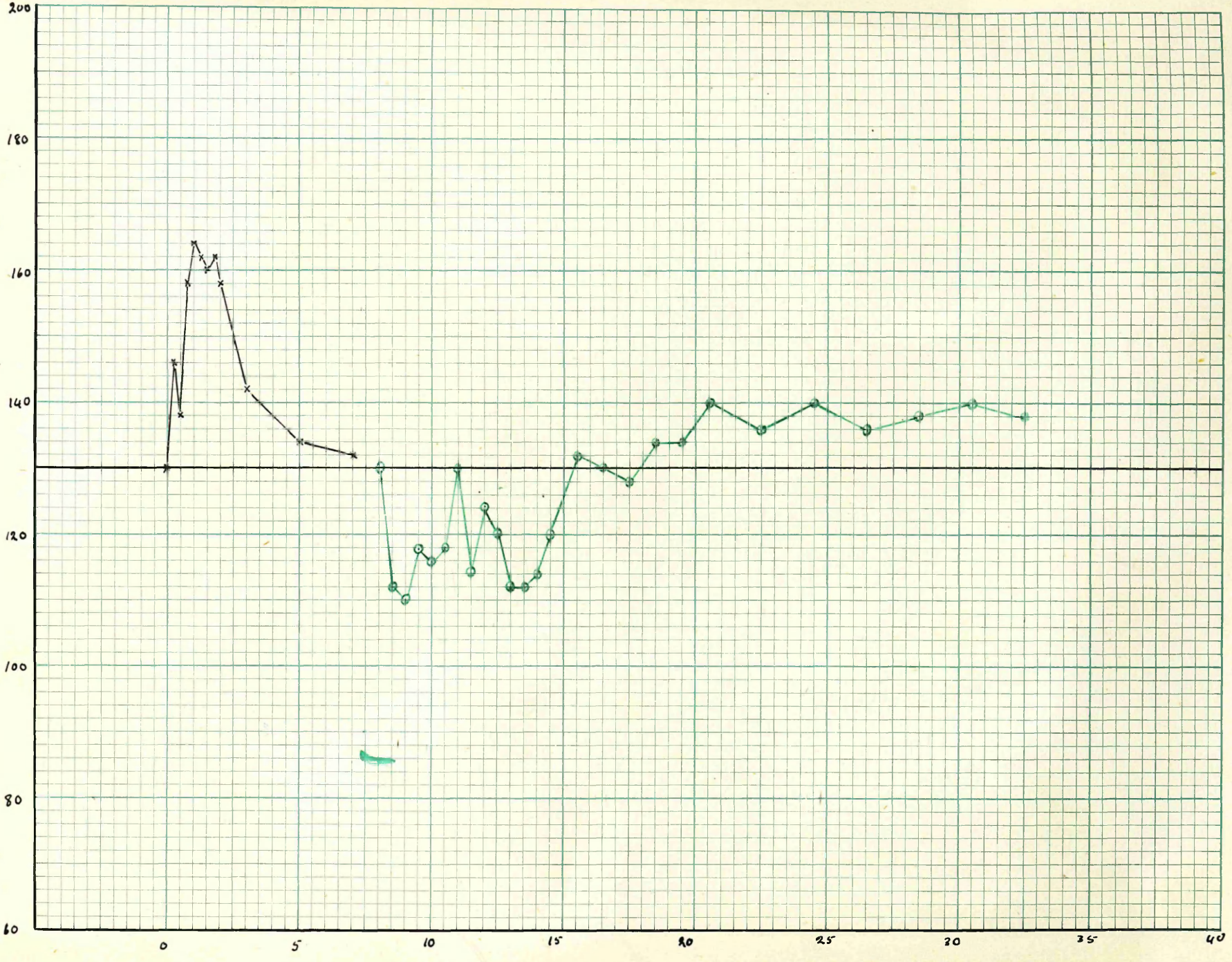
~~1992.~~
1242

ELLIS JW DAY 0

O'CONNOR TJ DAY 3


200
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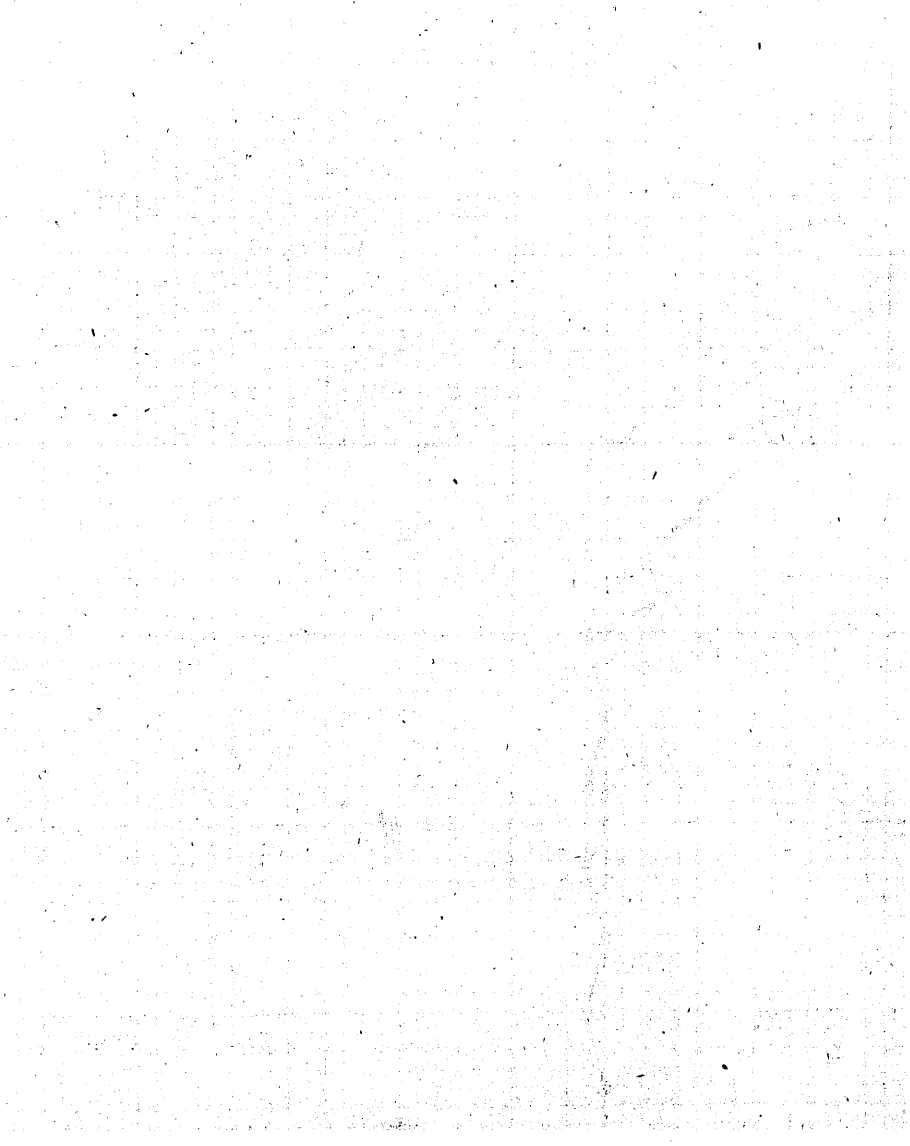
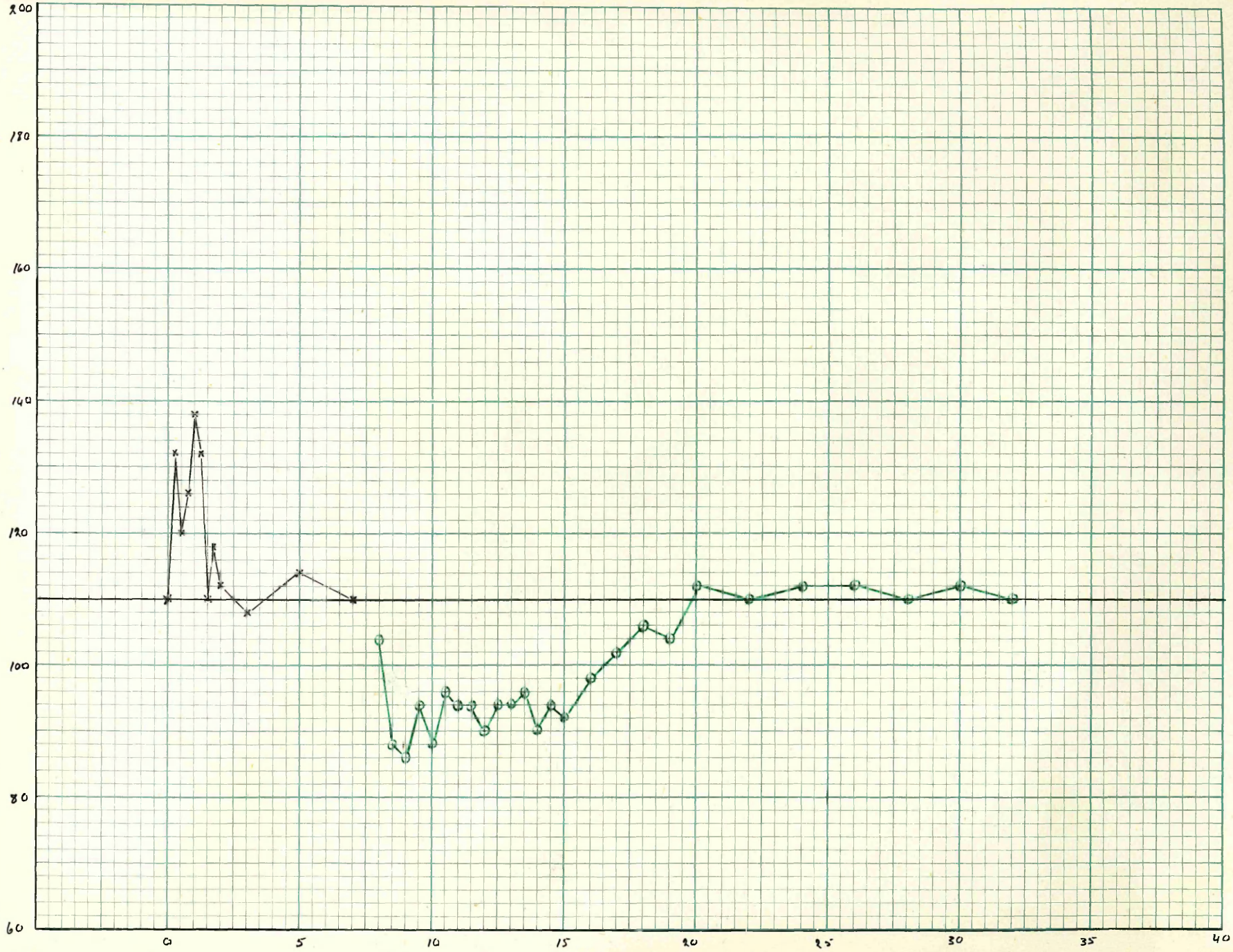
~~H 0 2~~.
1292

WARD A DAY 3.

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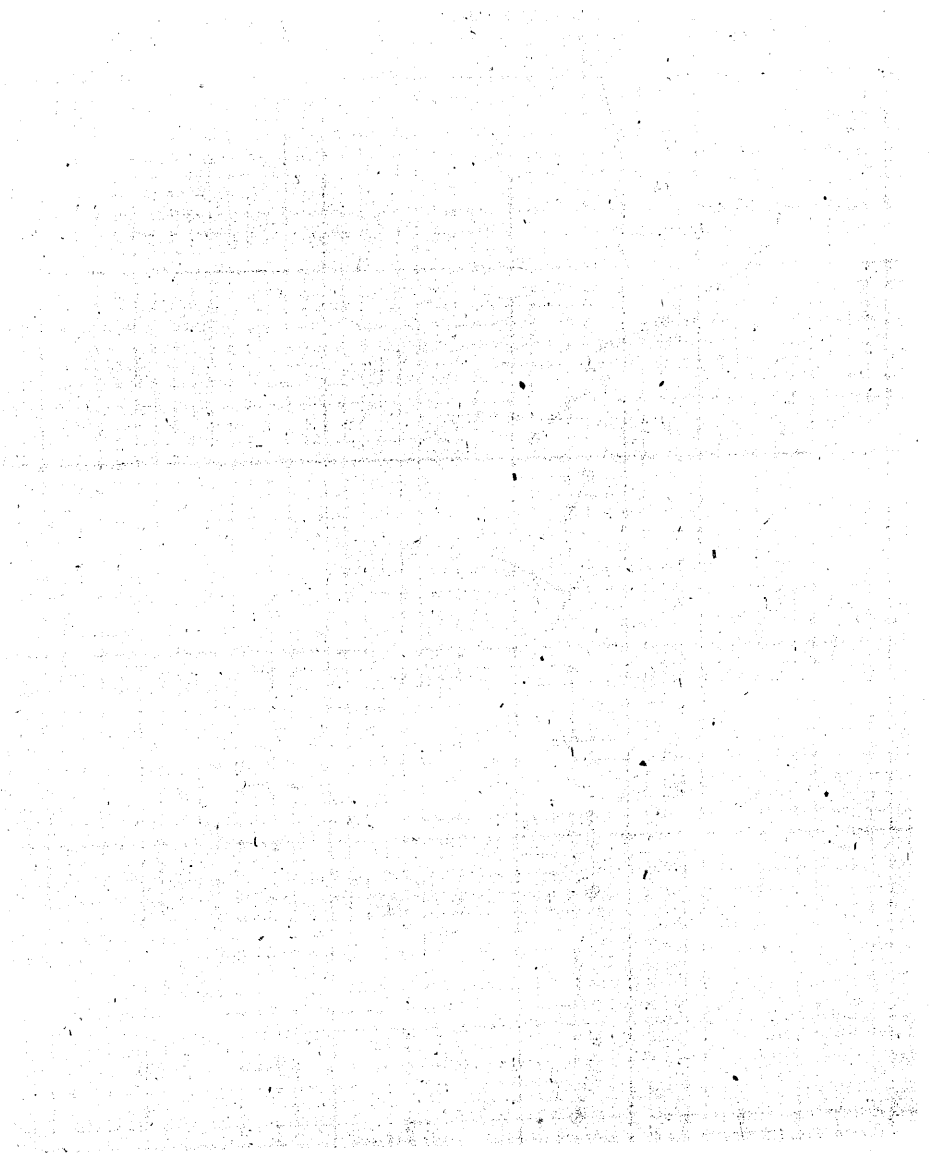

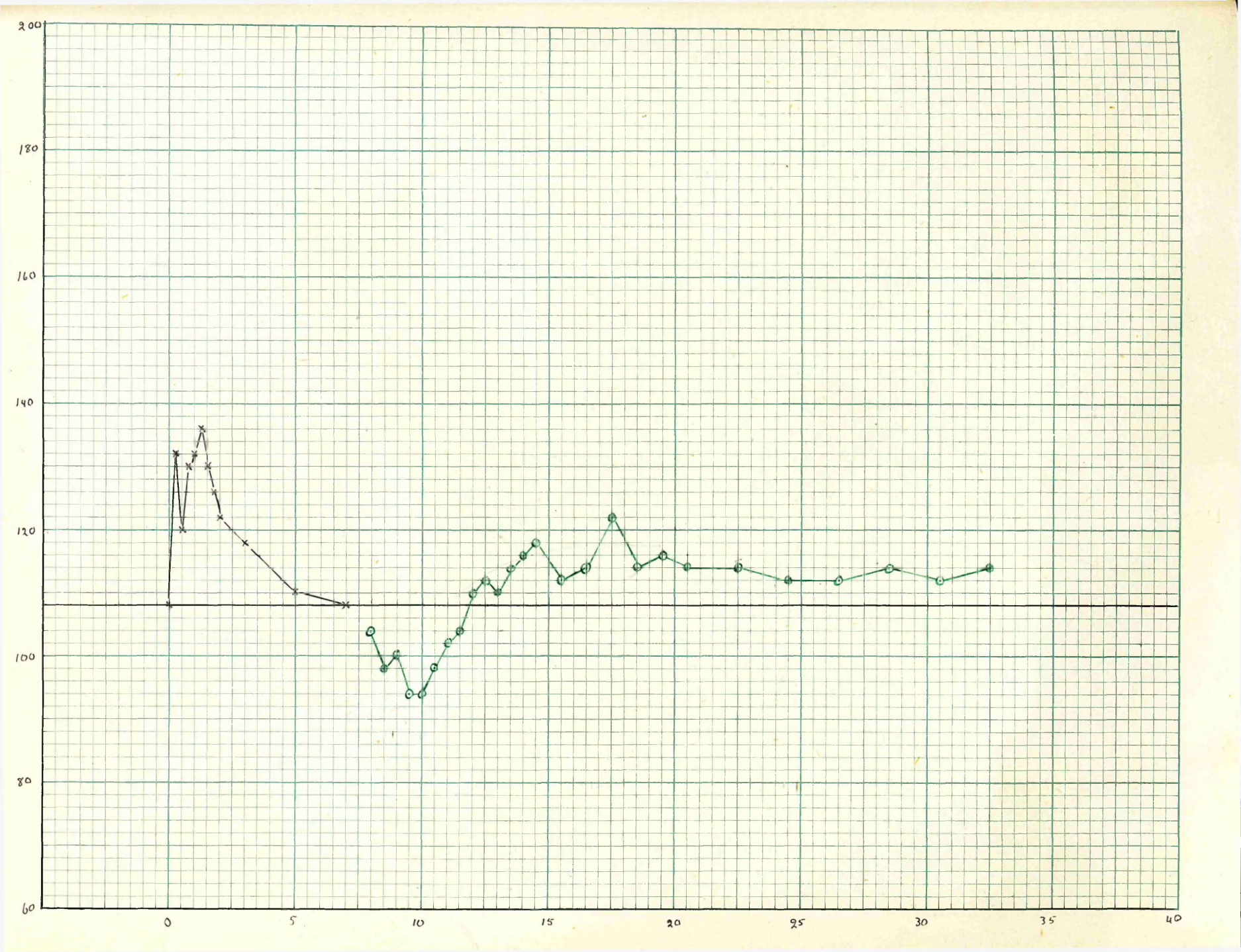
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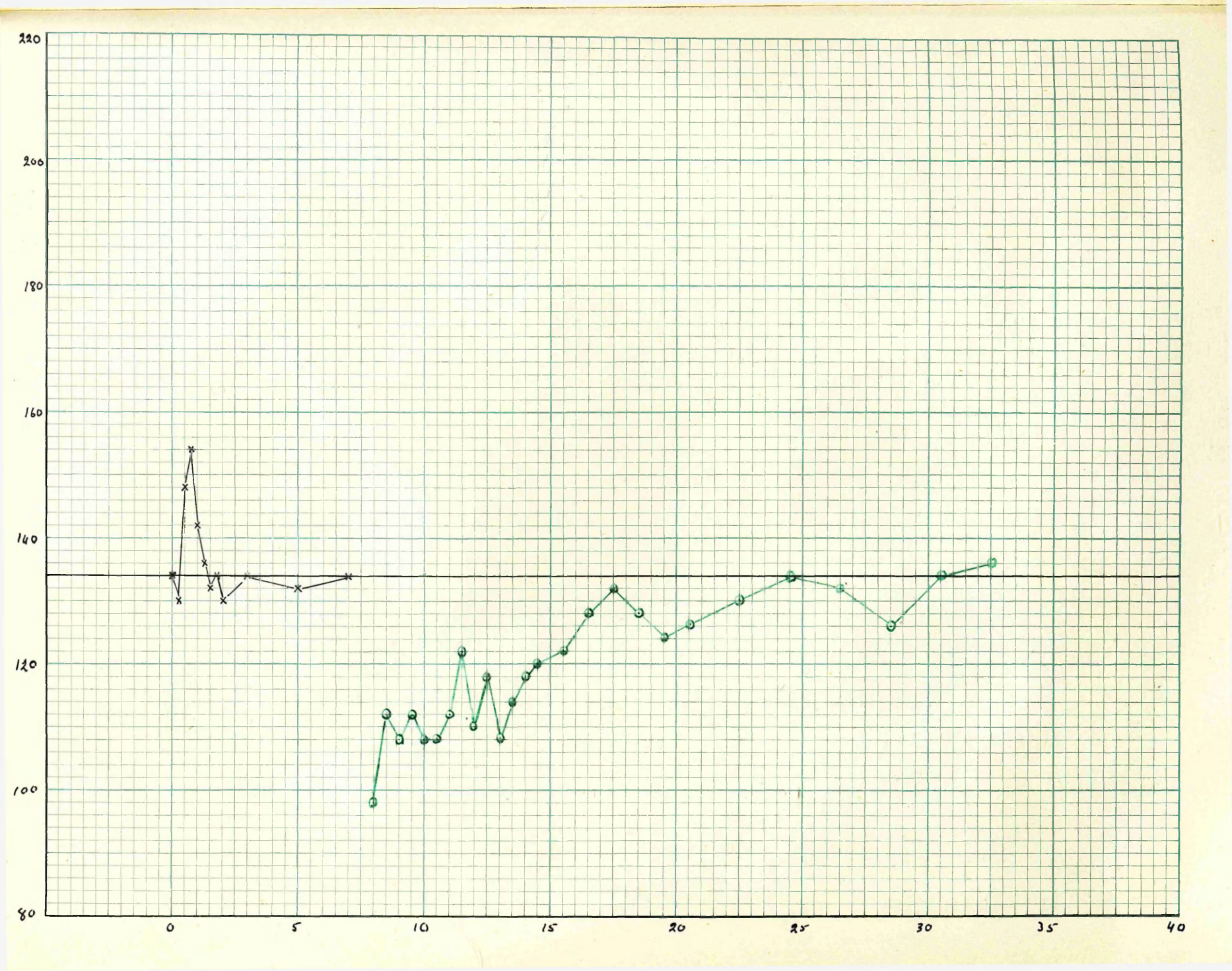
1372

ROBINS R DAY 3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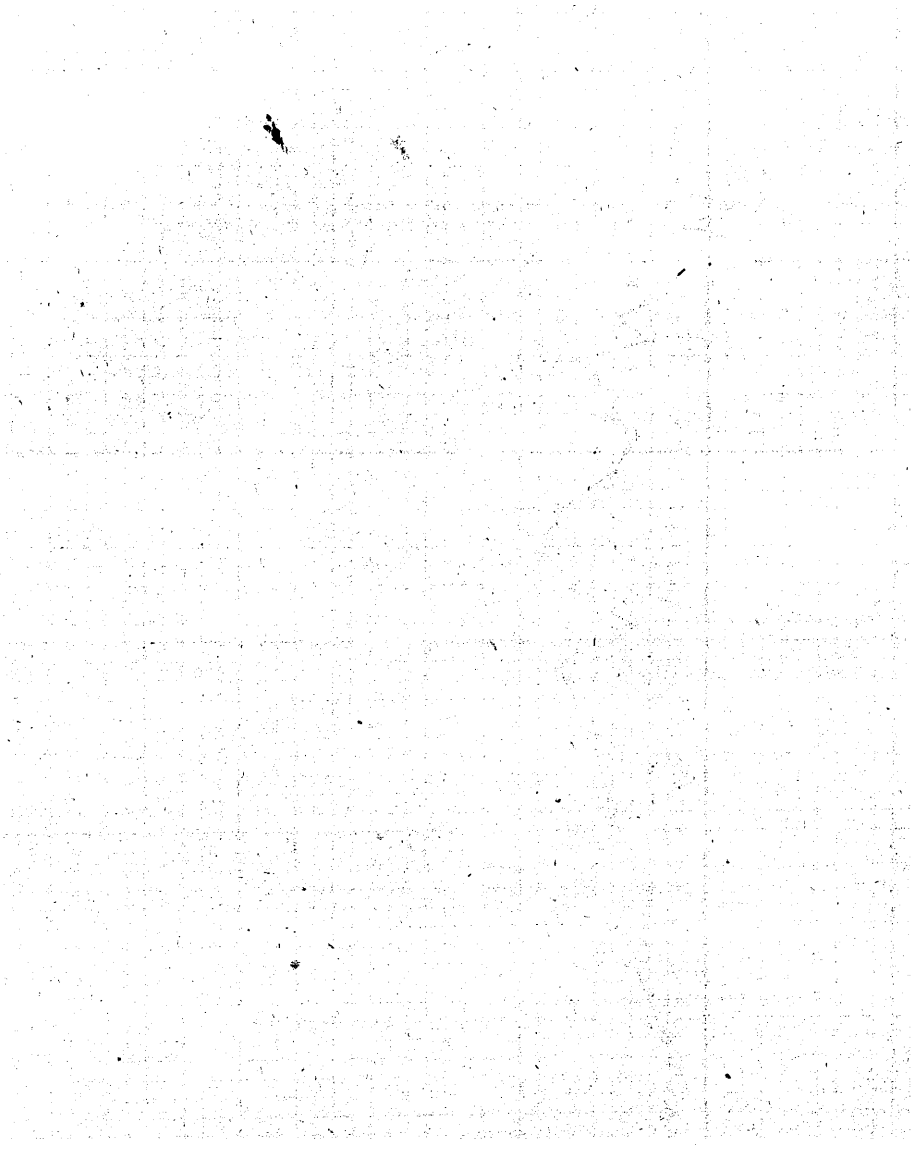
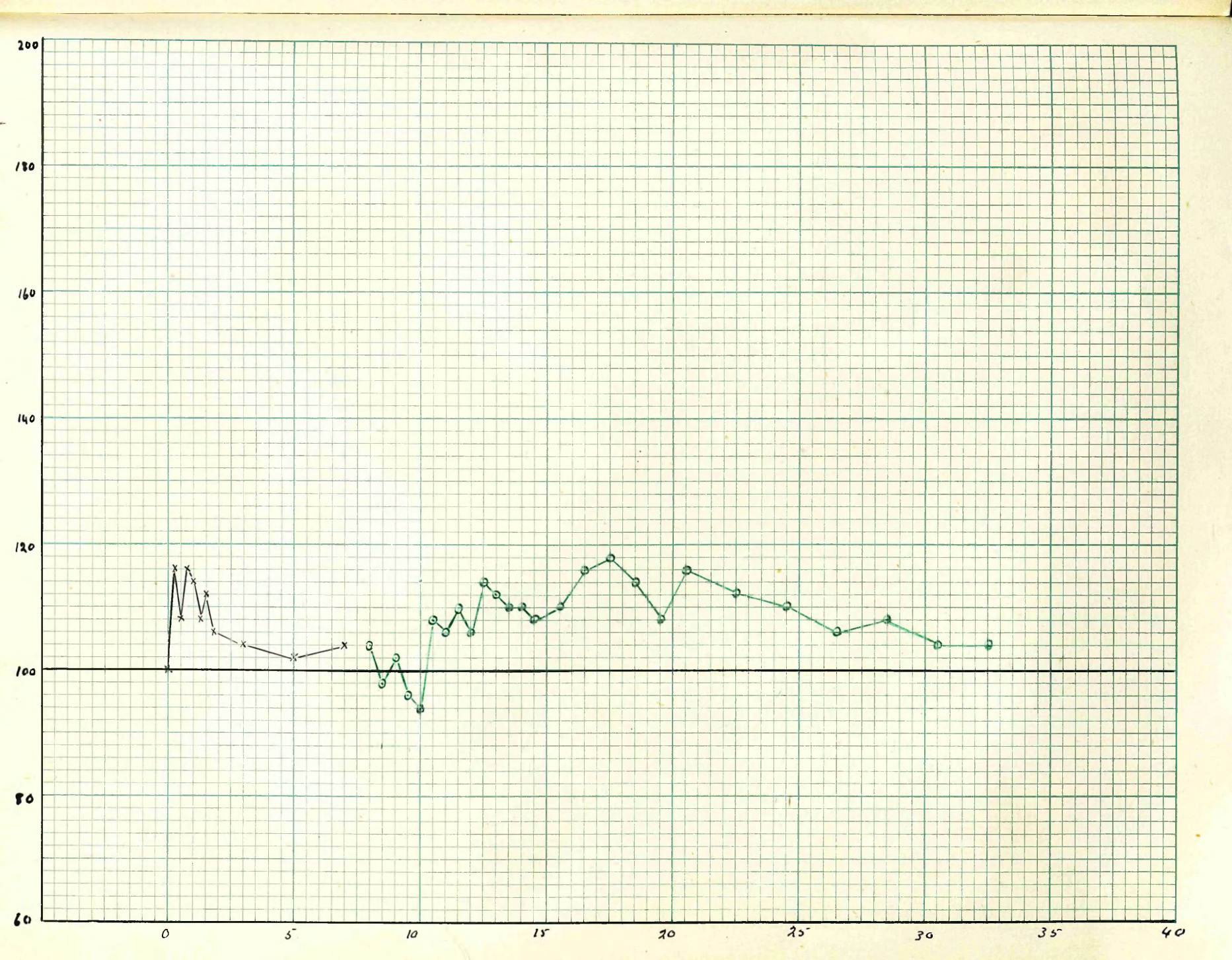
~~1132~~ WOOD B DAY 3

1392

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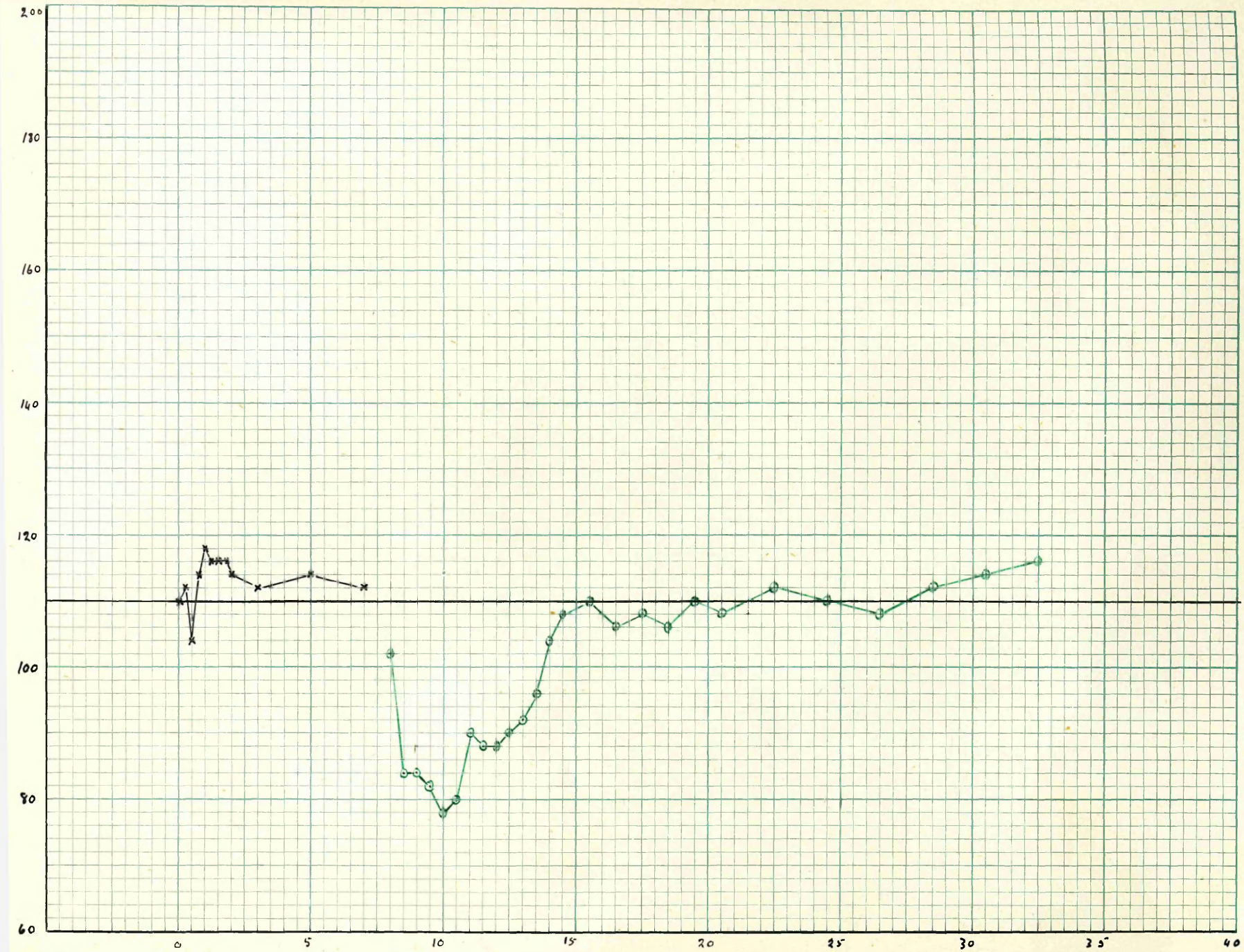
~~1442.~~ HIRST P DAY 3

1422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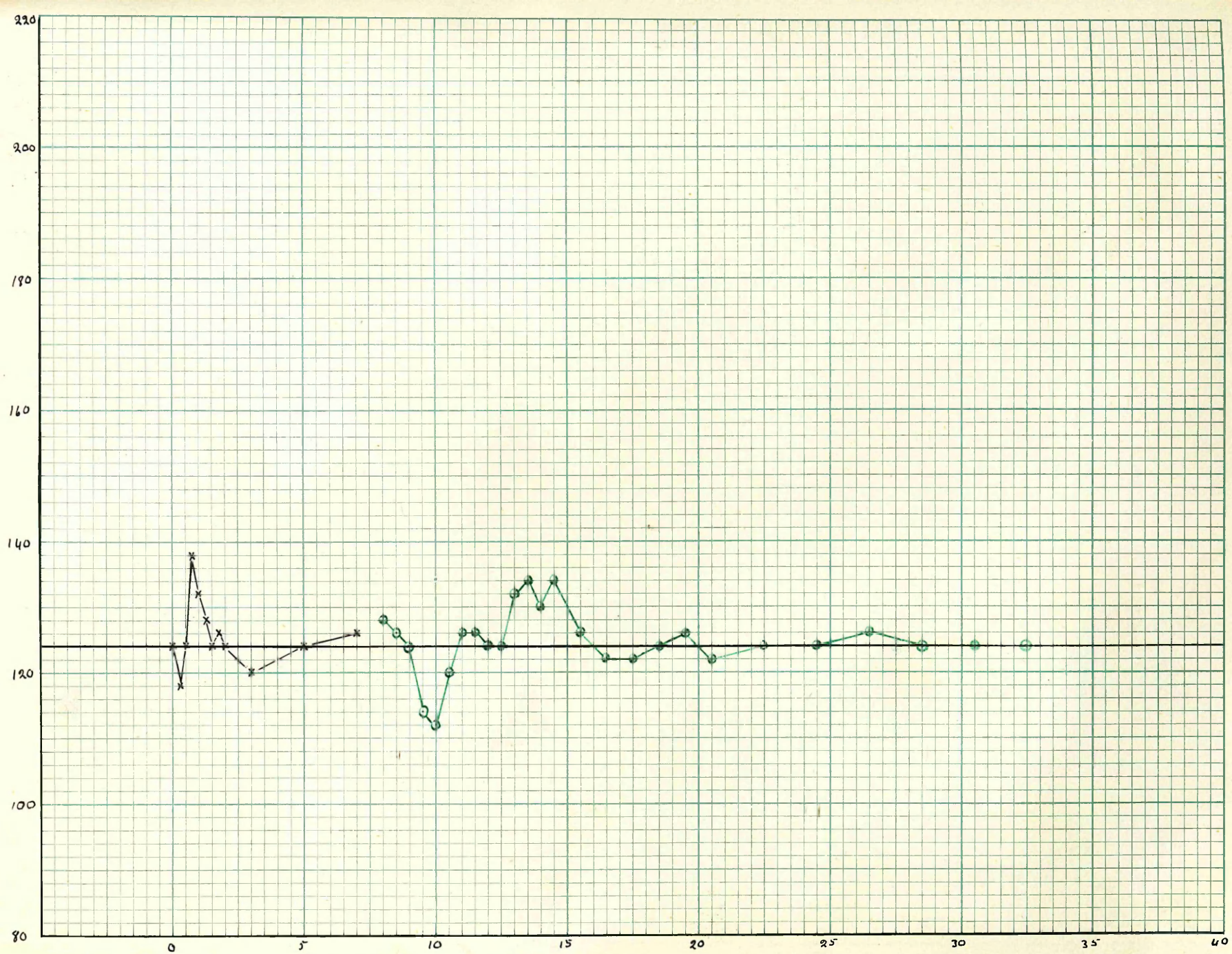
1452

BAKER J G DAY 3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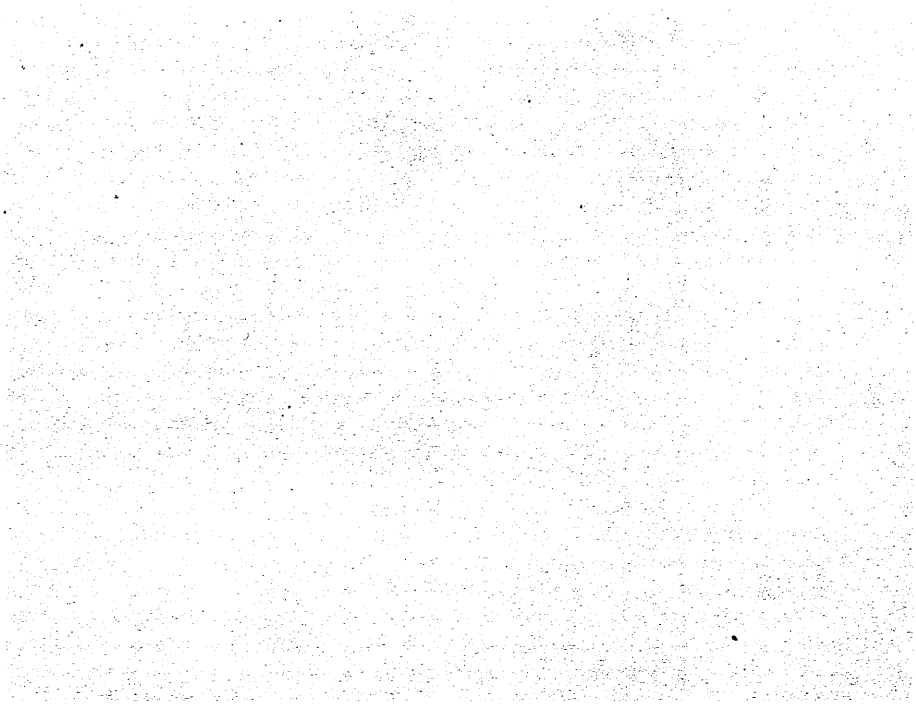
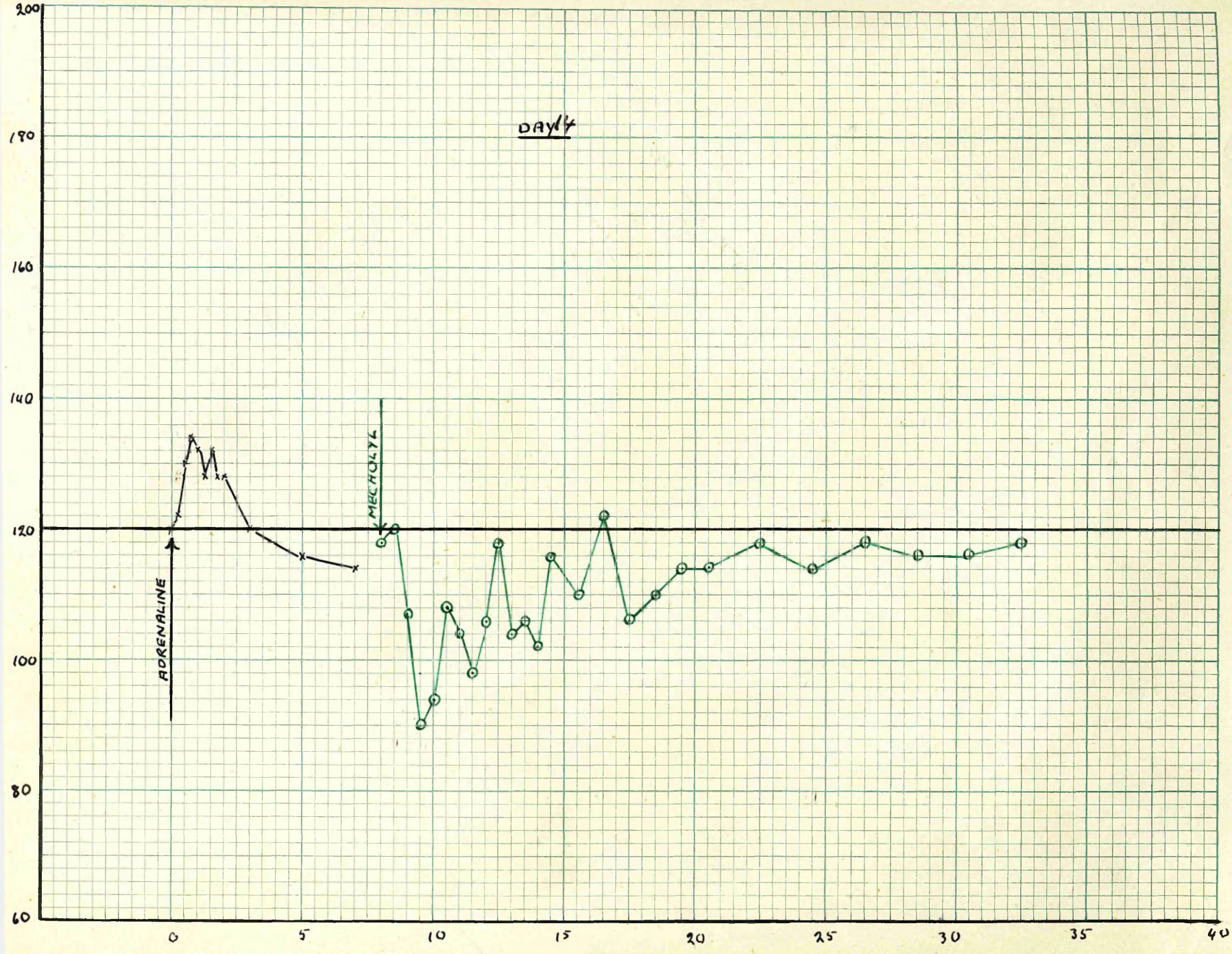
SCHIZOPHRENICS TESTED AFTER A FOURTEEN-DAY INTERVAL.




DAY 4
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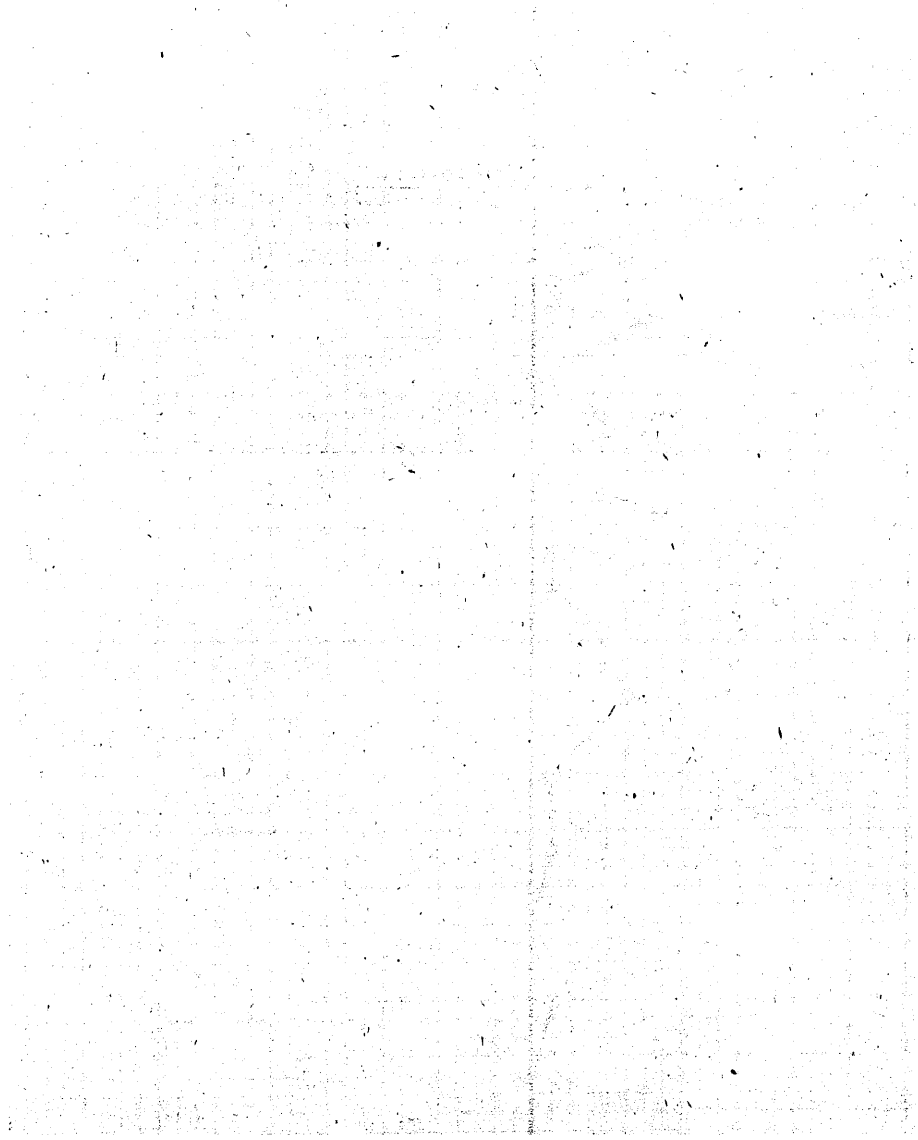

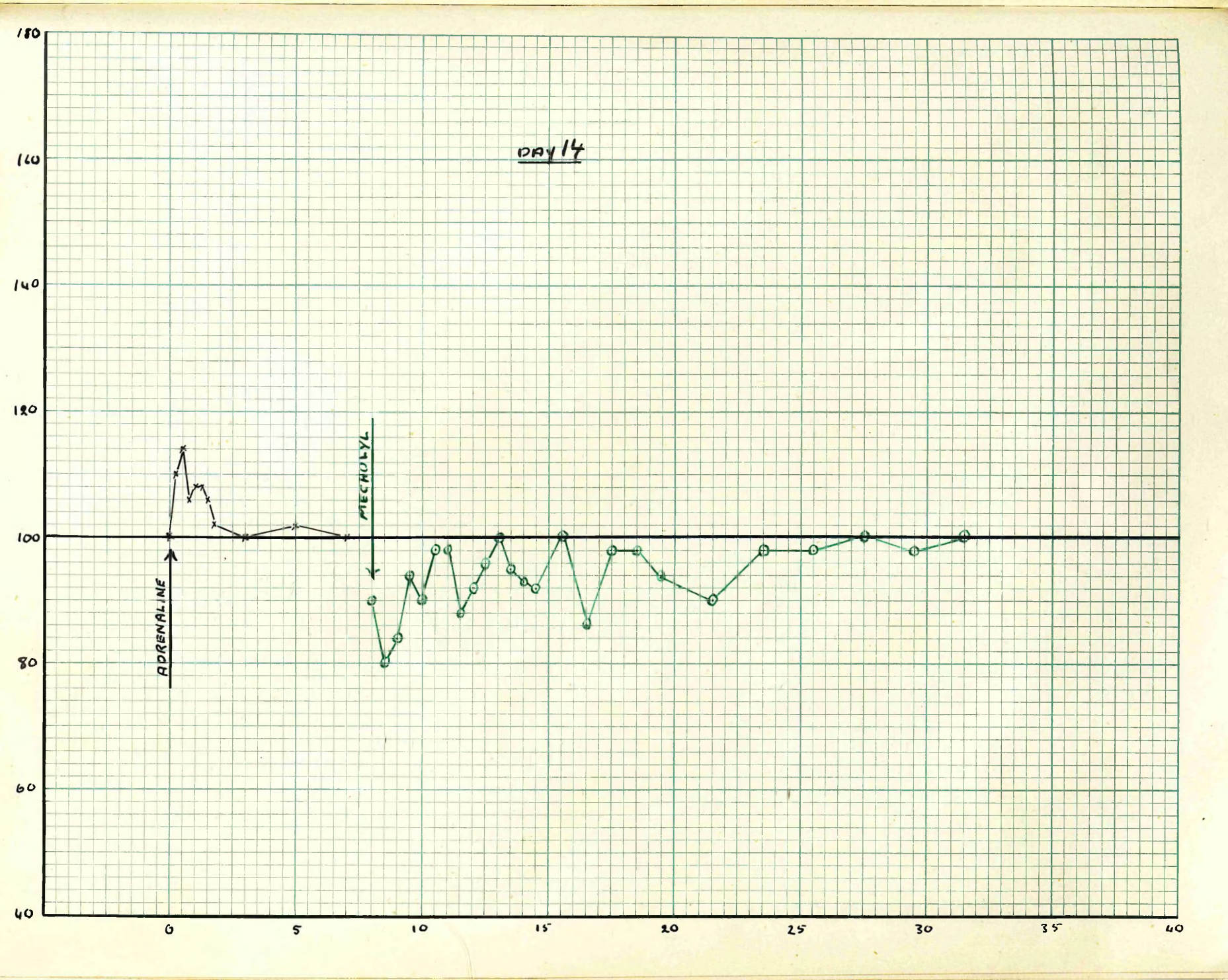
DAY 14
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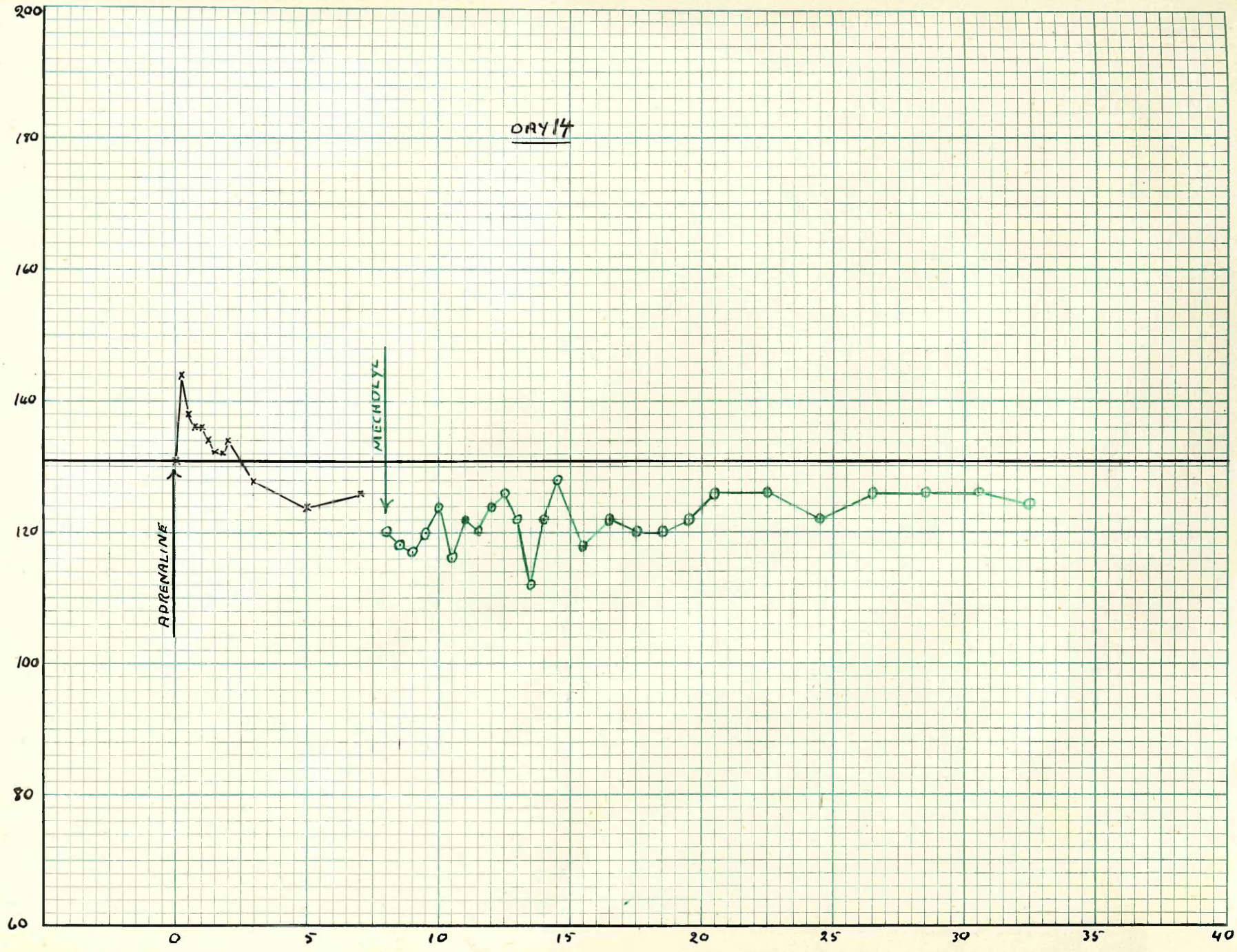
DAY 14
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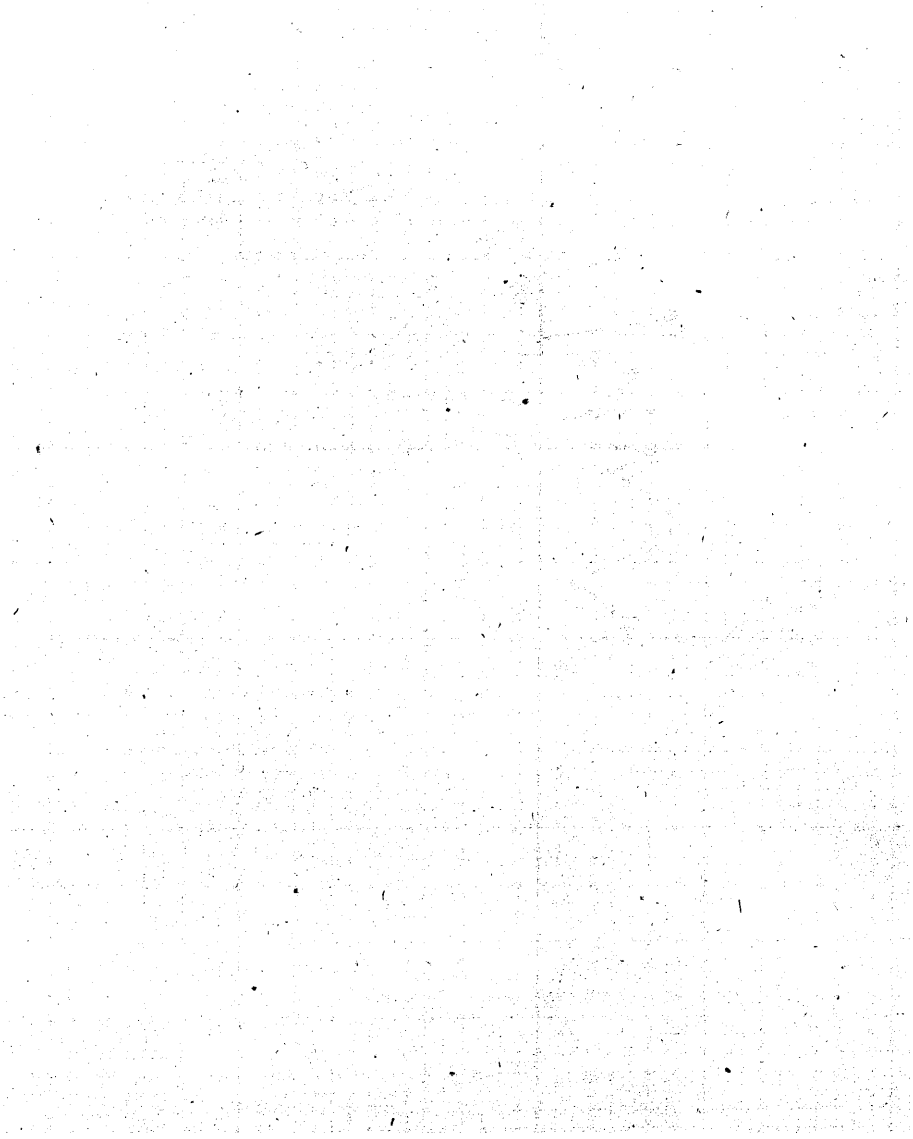

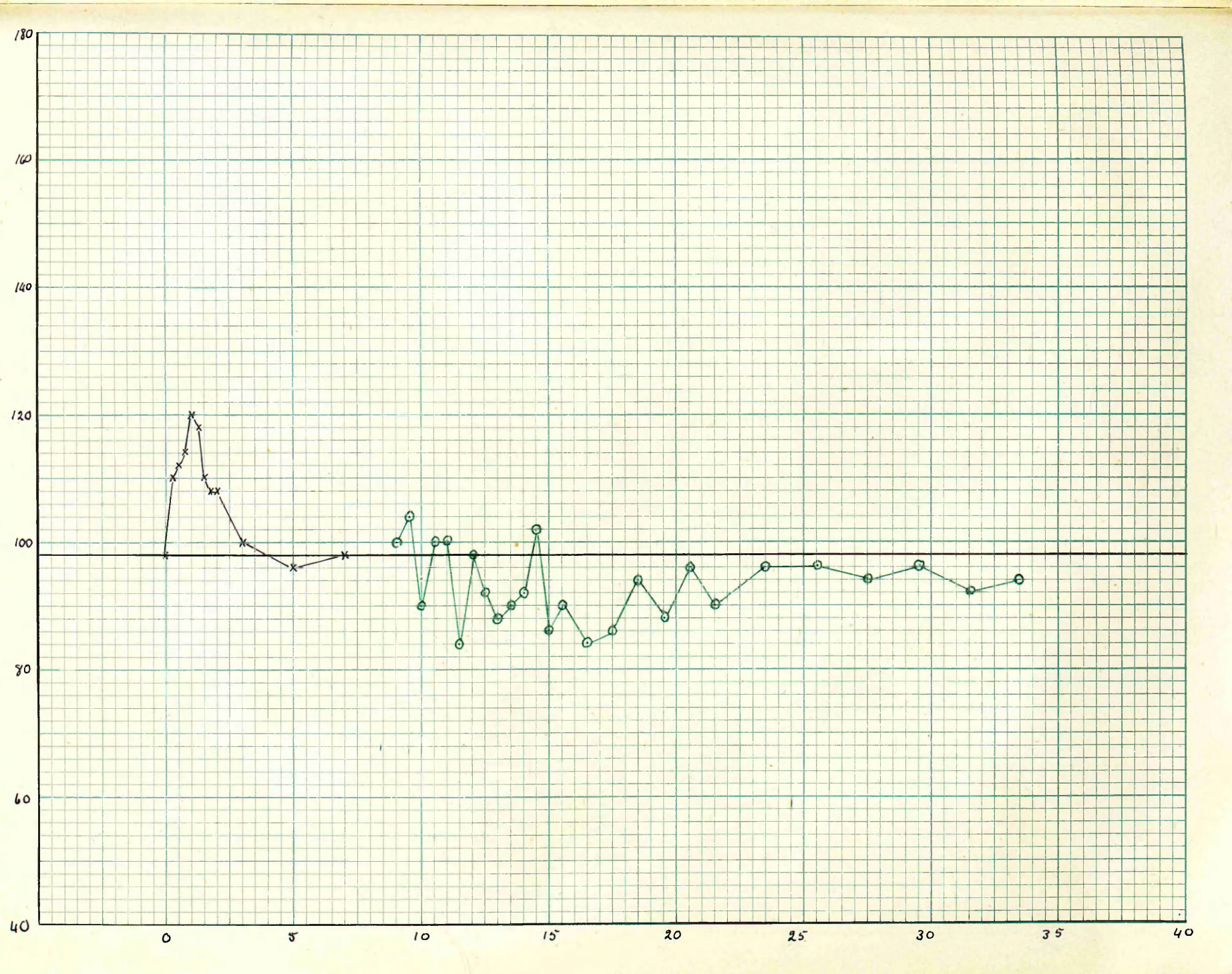
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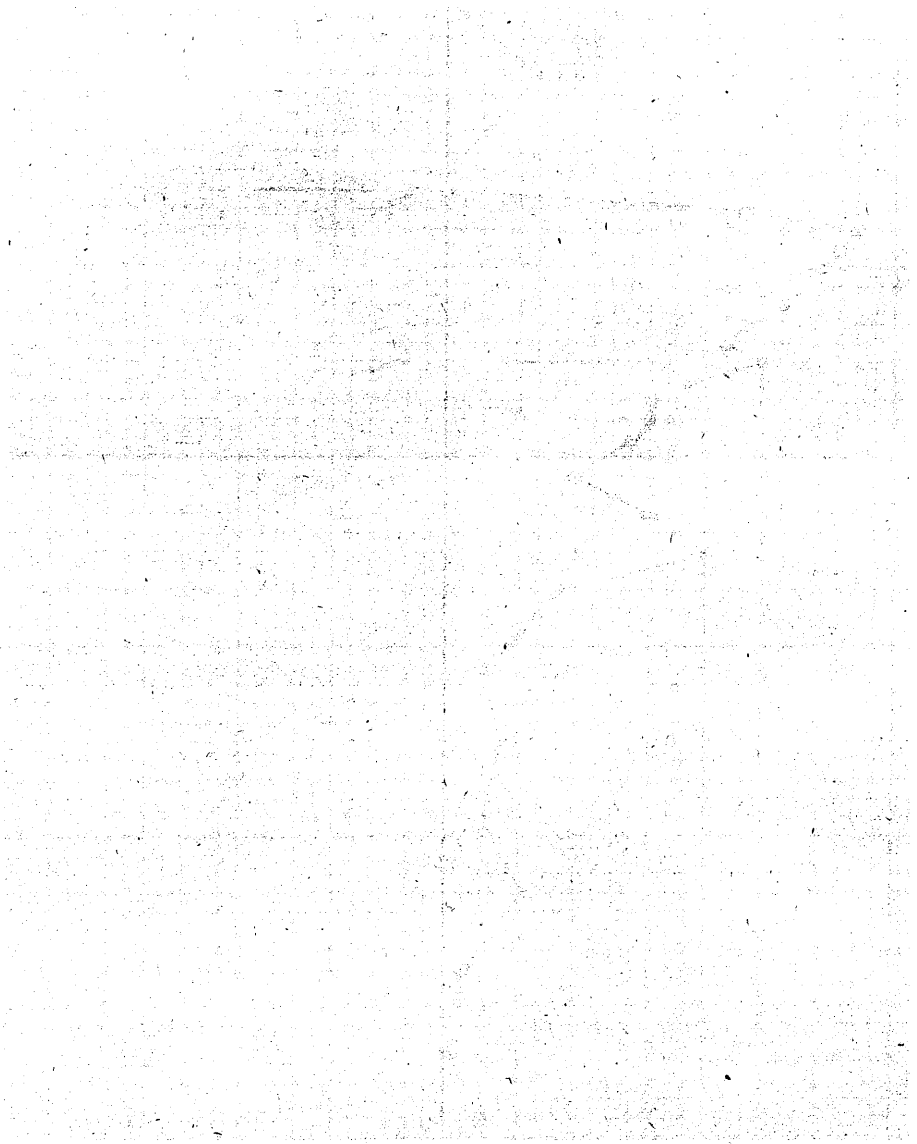
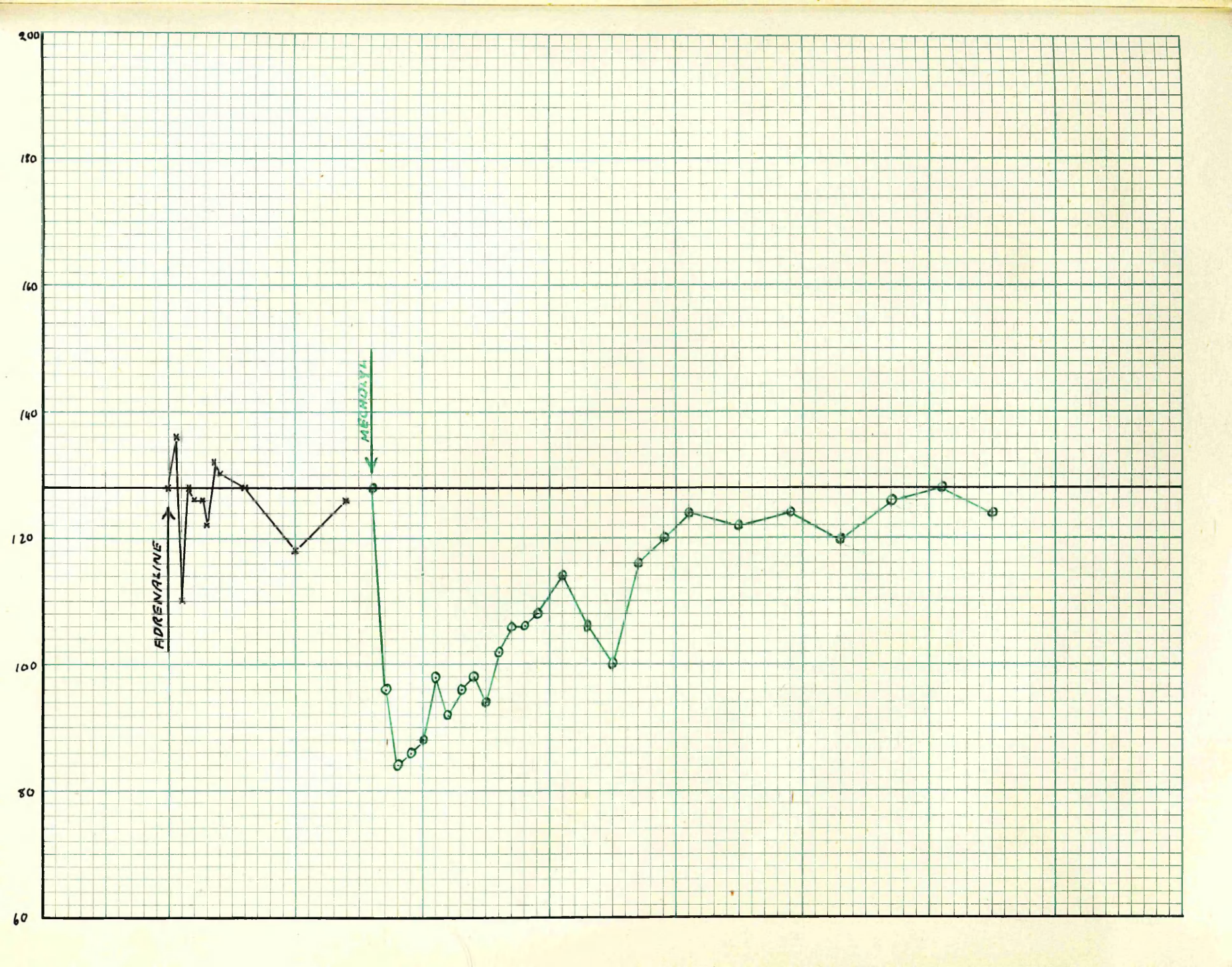
BLAKEY C DAY 14

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ADRENALINE
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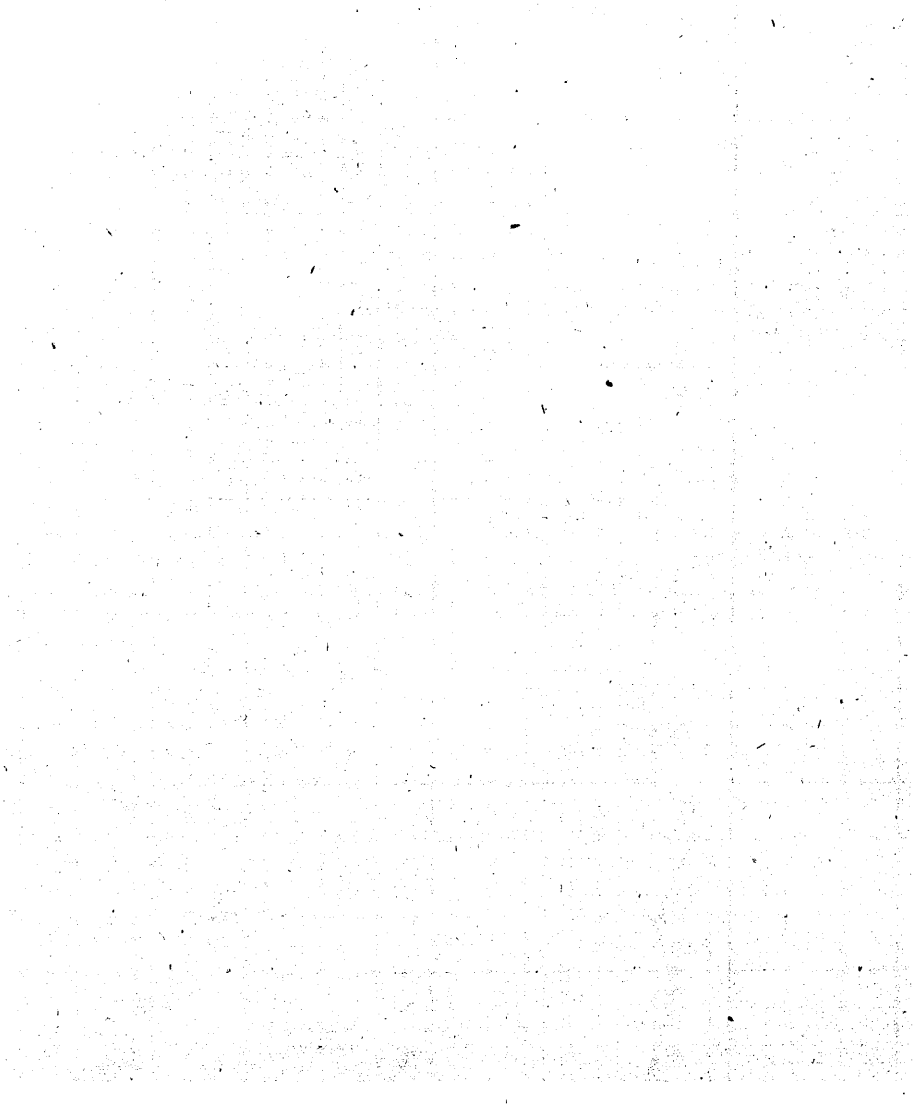
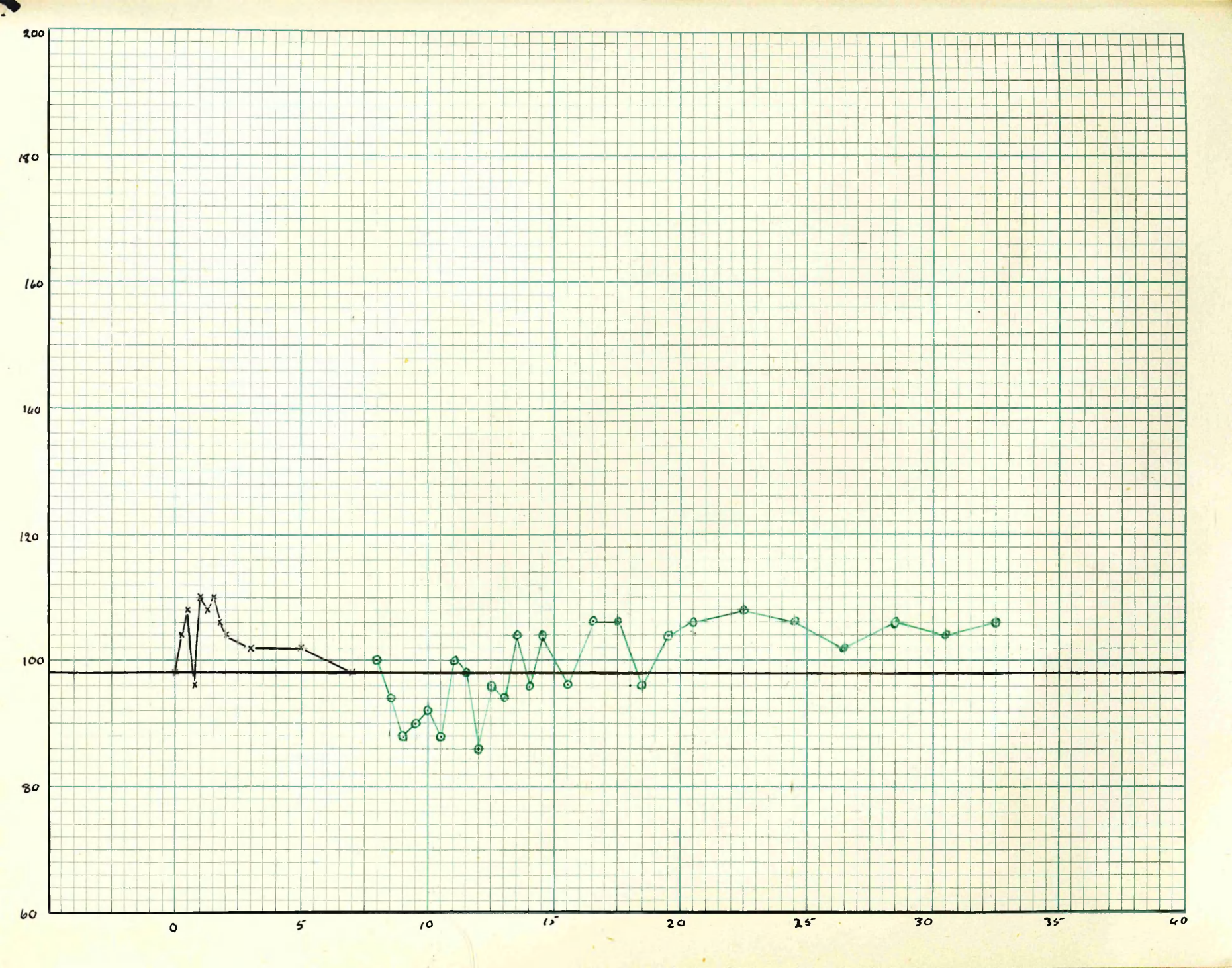
1163

LUMB 3 DAY 14

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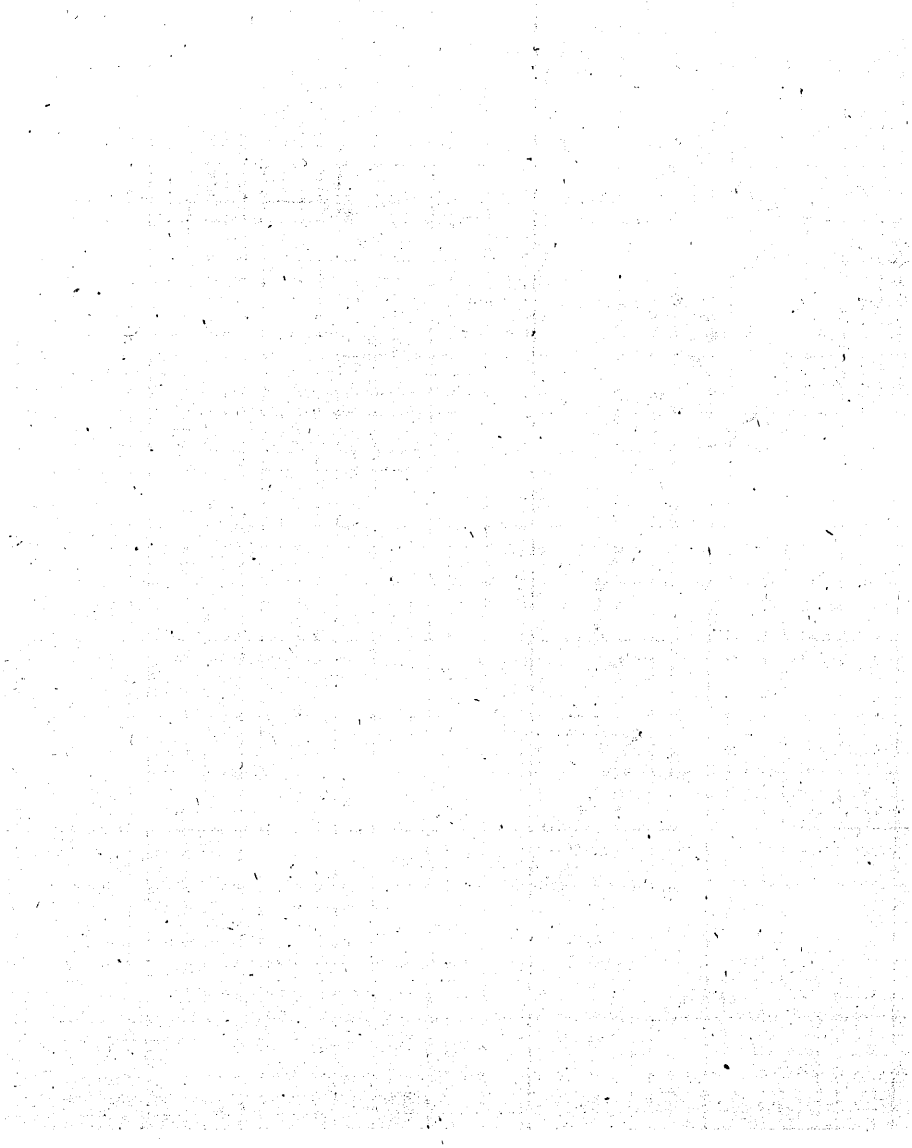

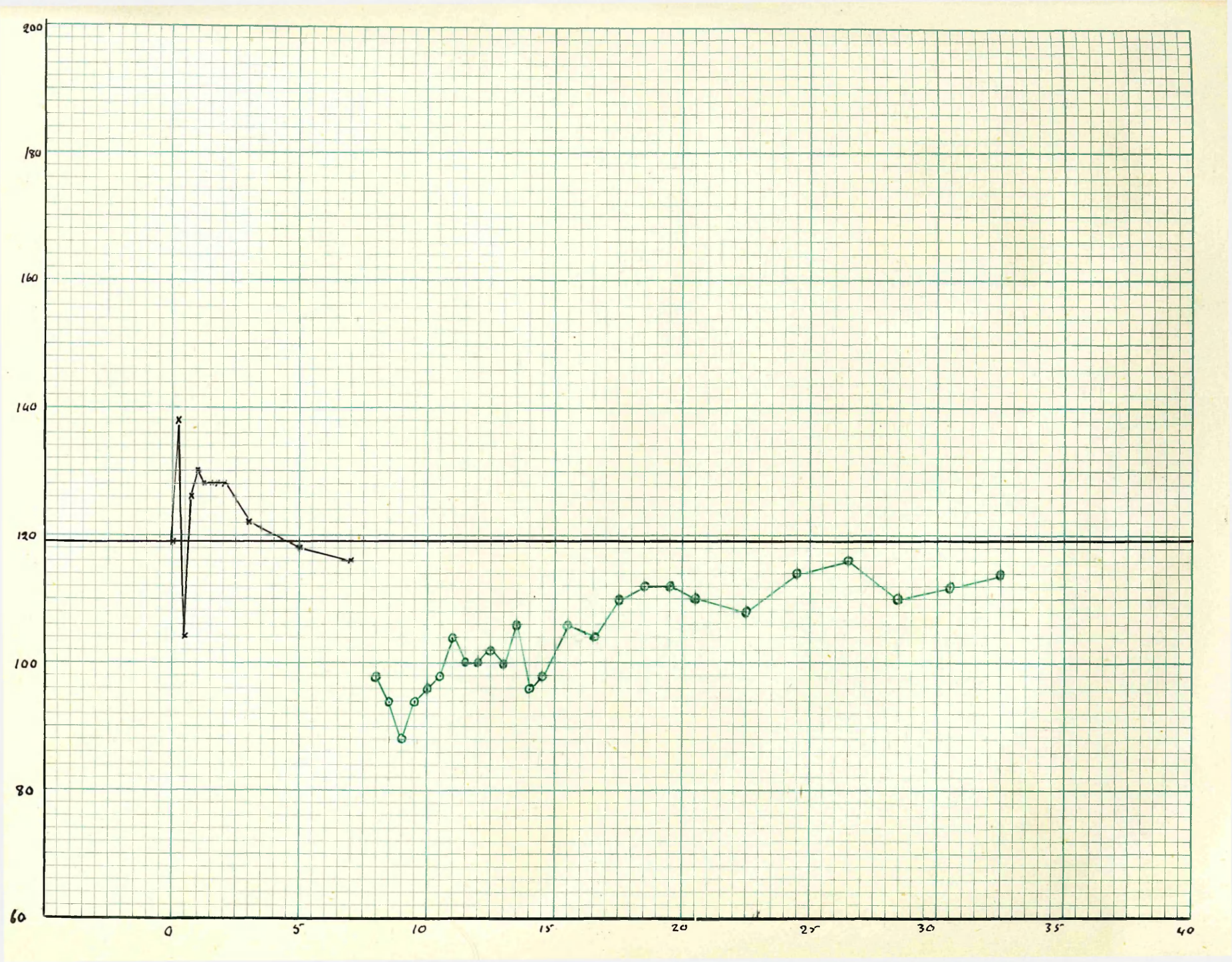
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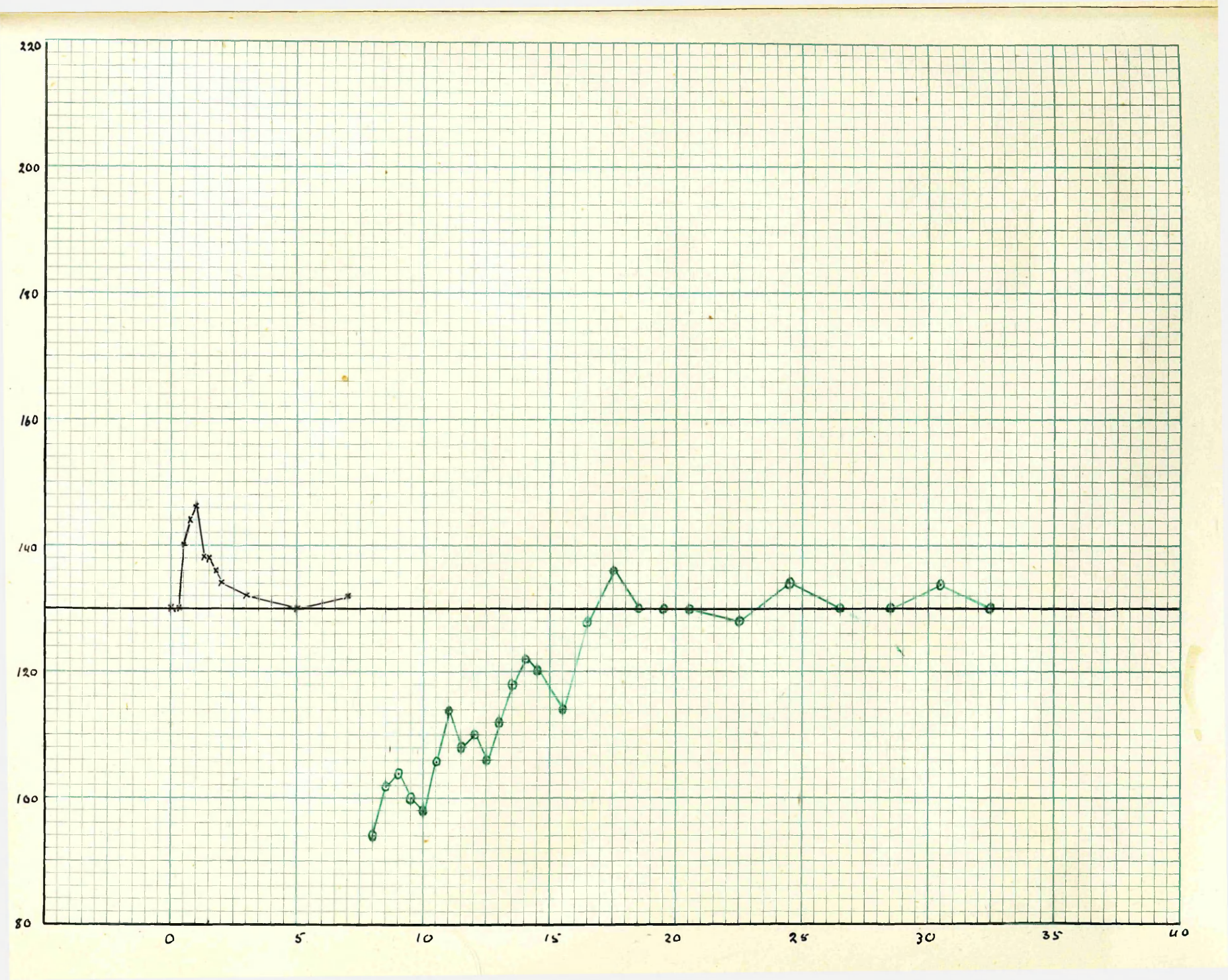
[illegible] MAY 14.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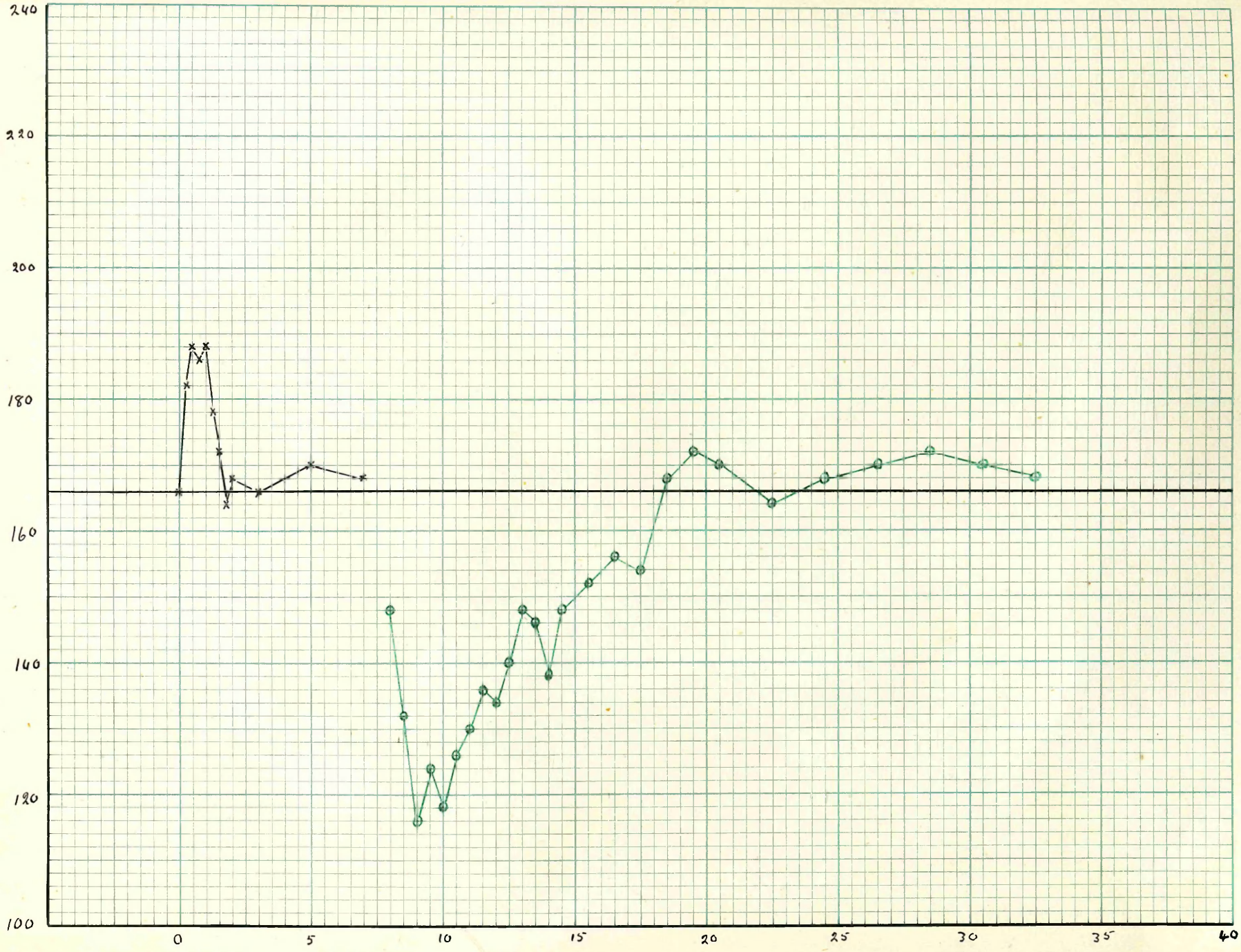
WILCOCK E DAY 14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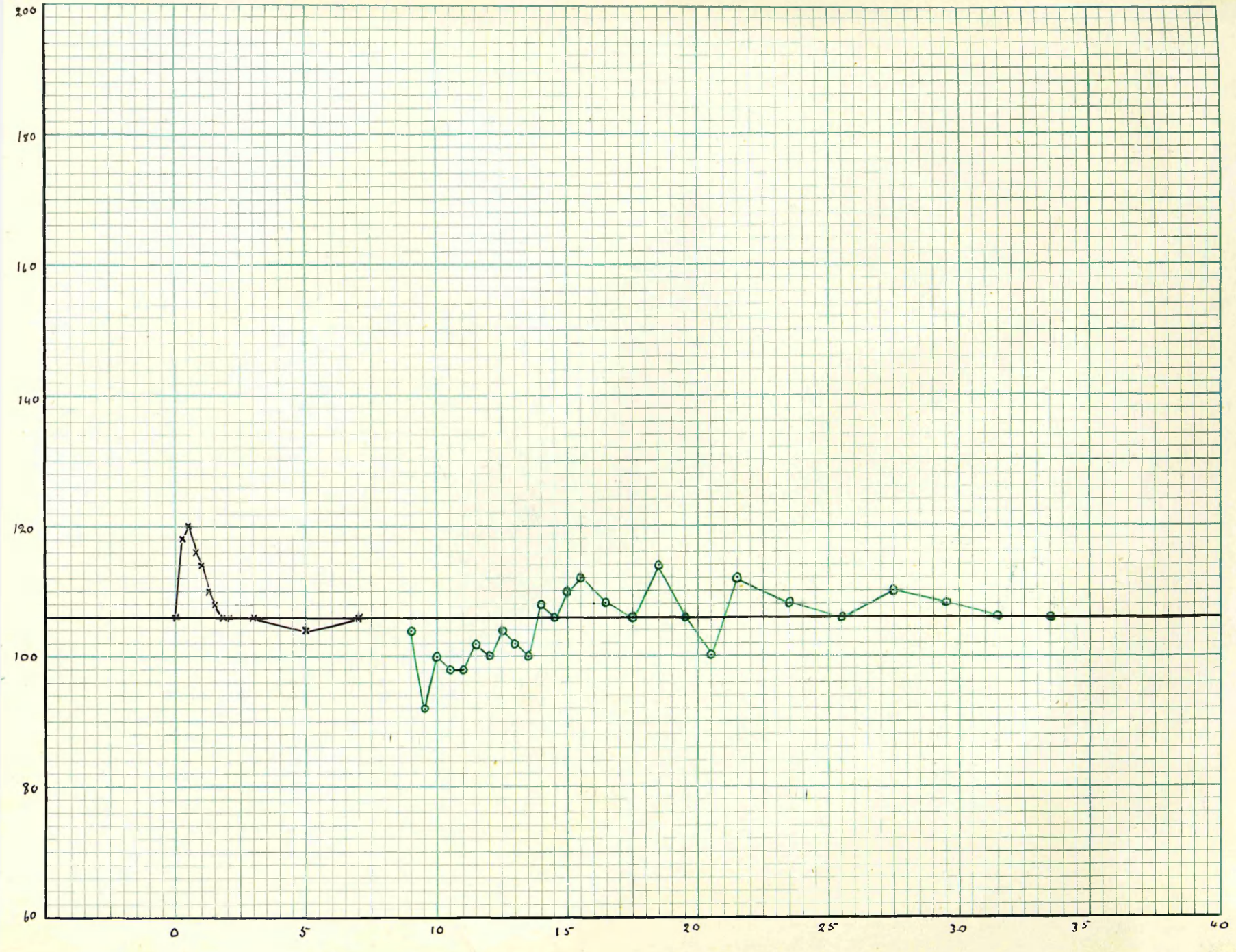
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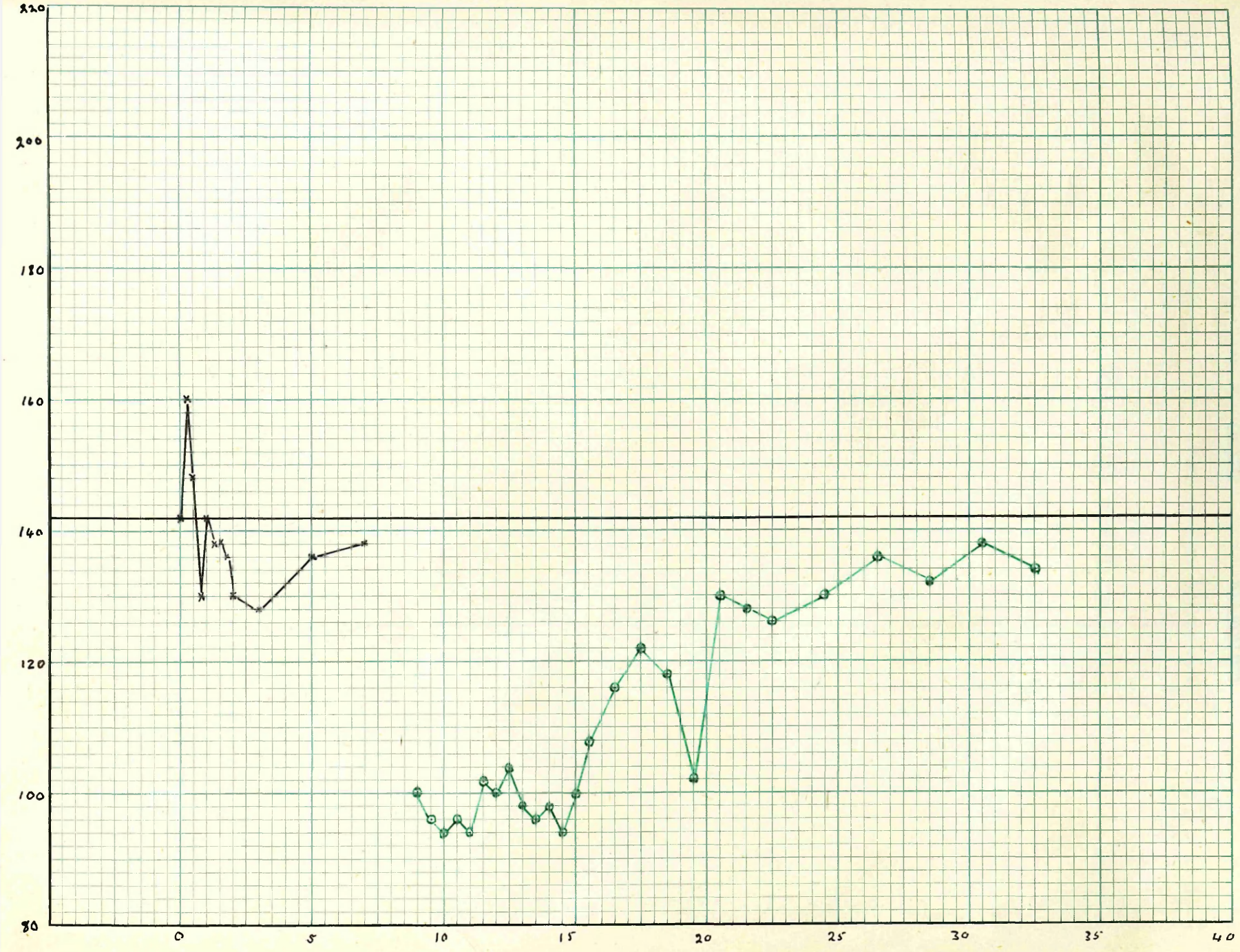
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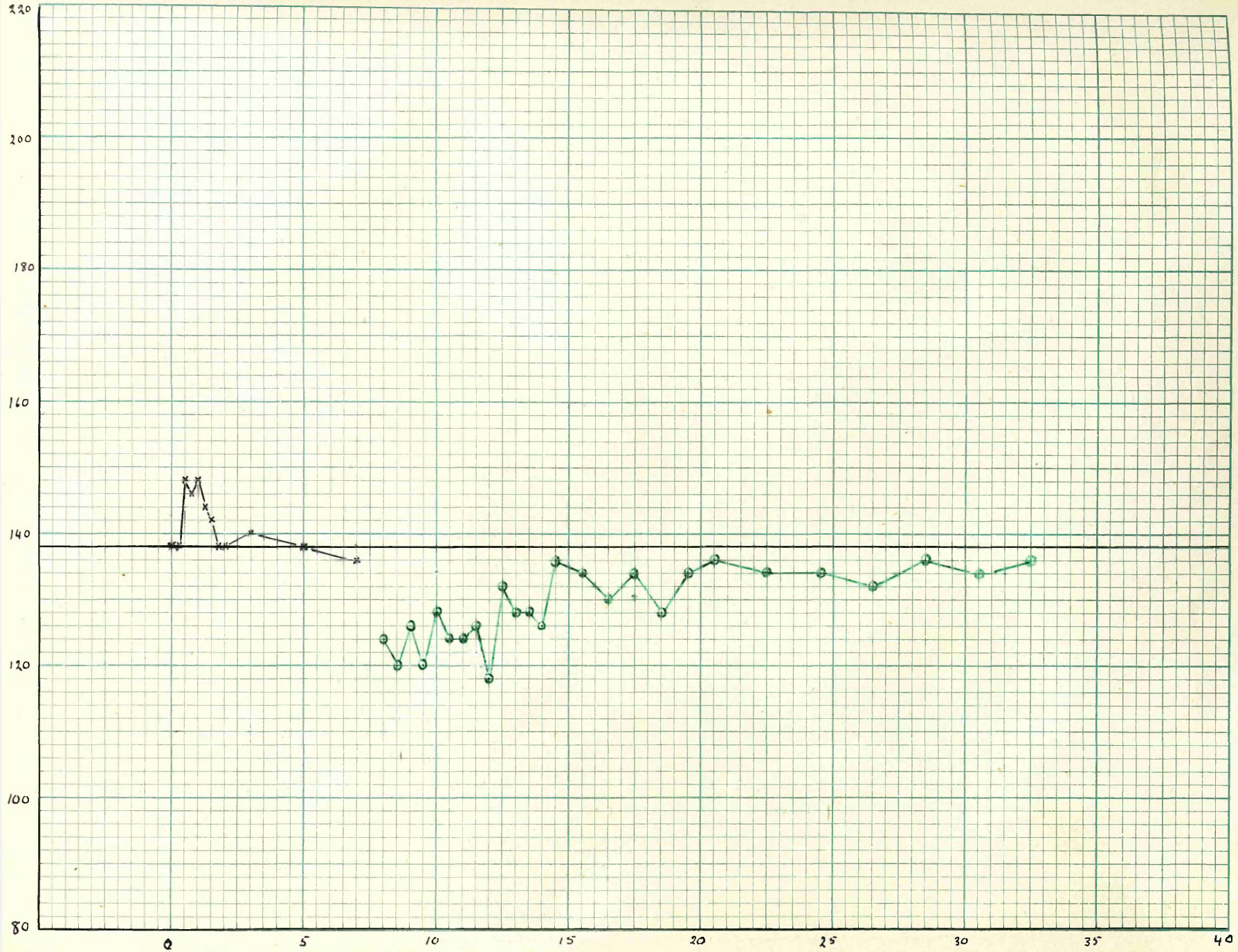
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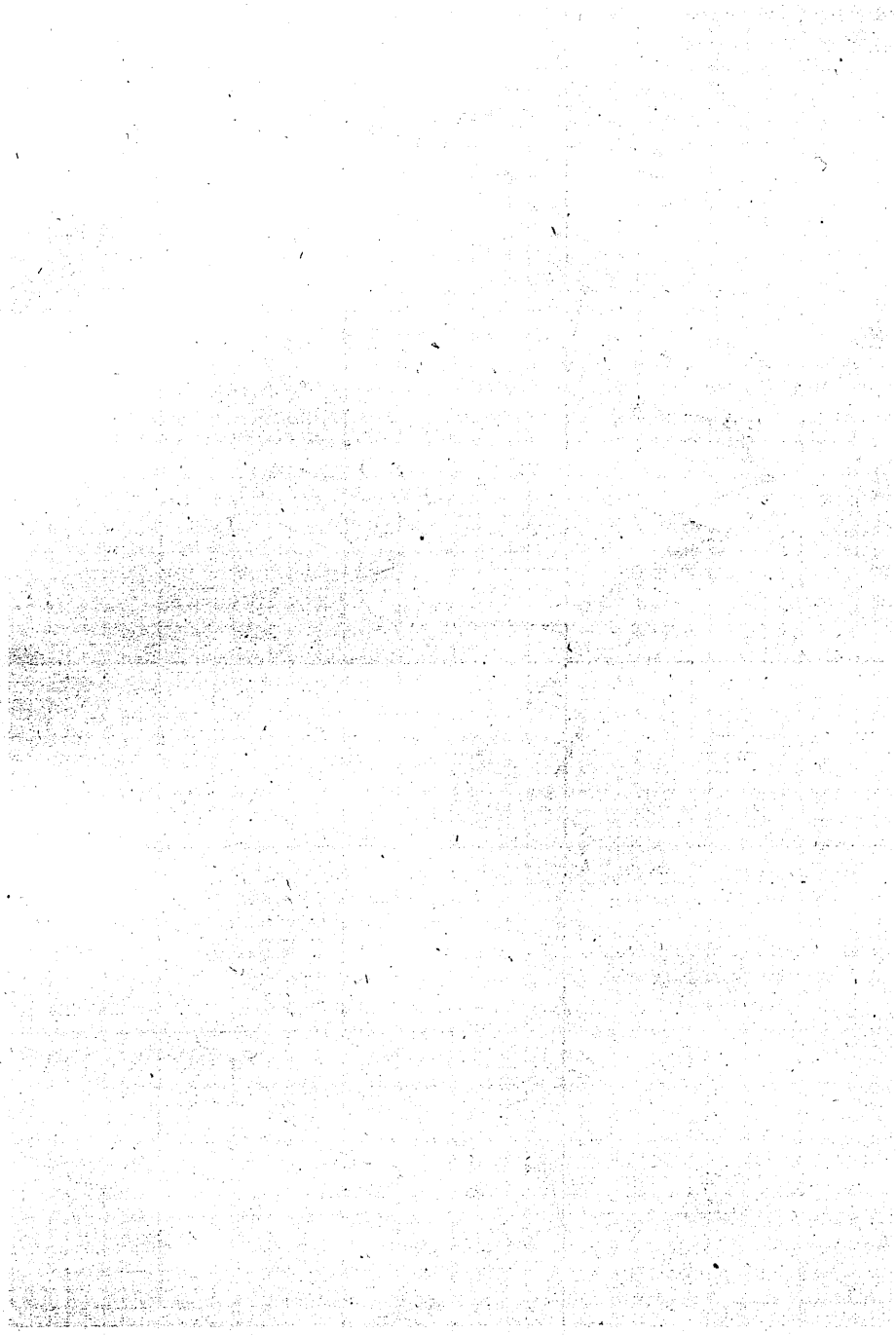
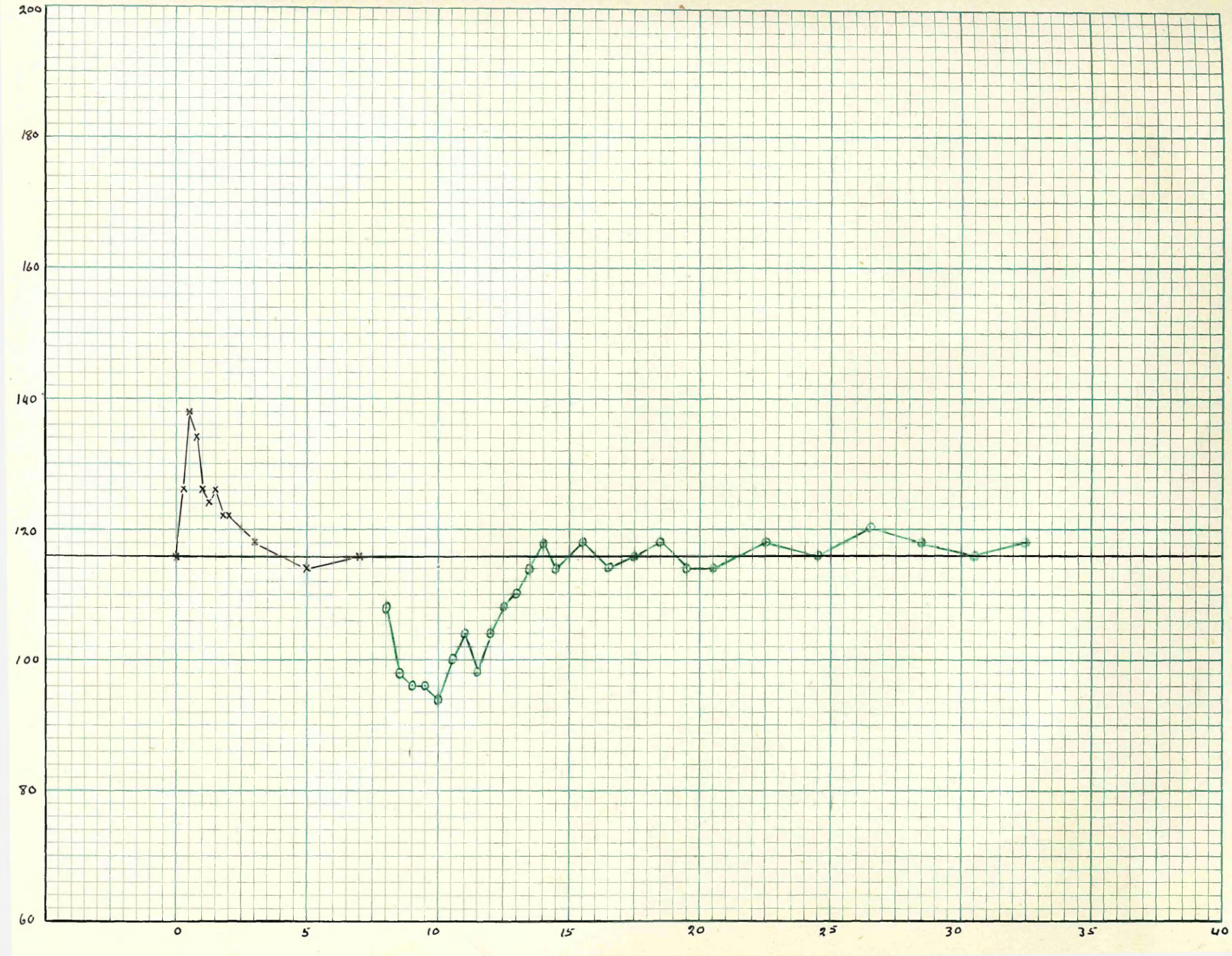
J SMITH (JUN) DAY 14

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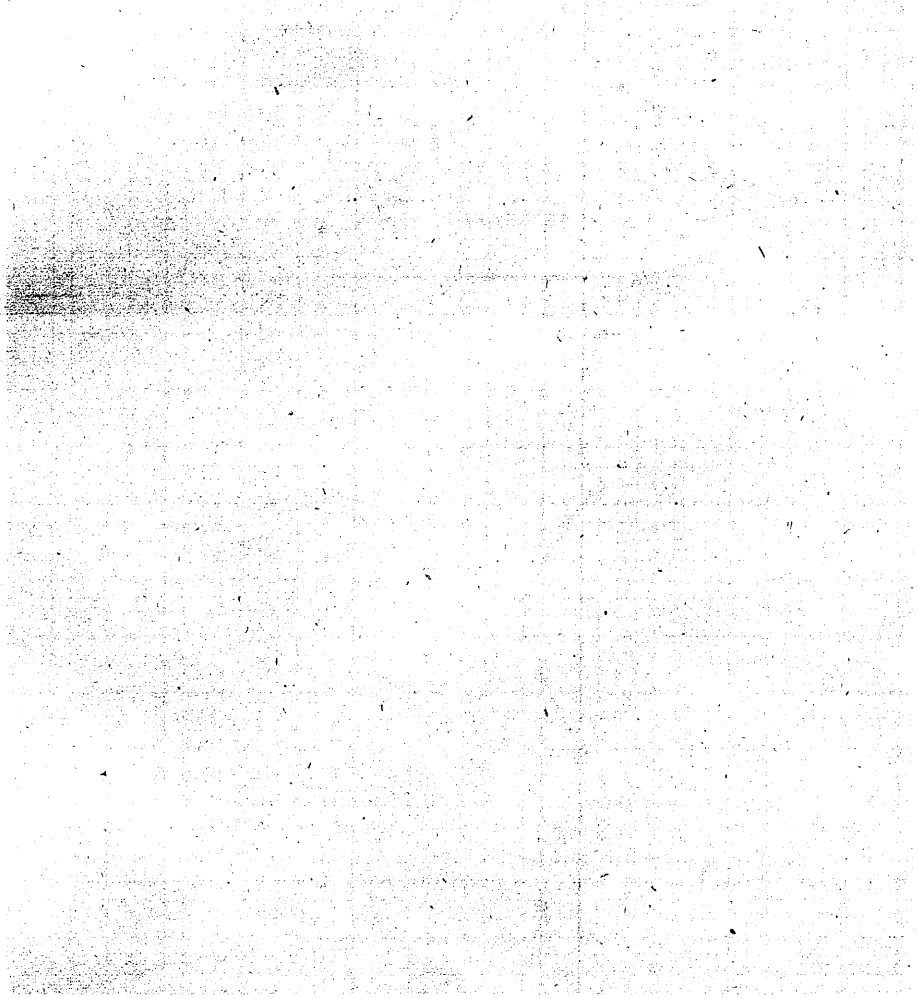

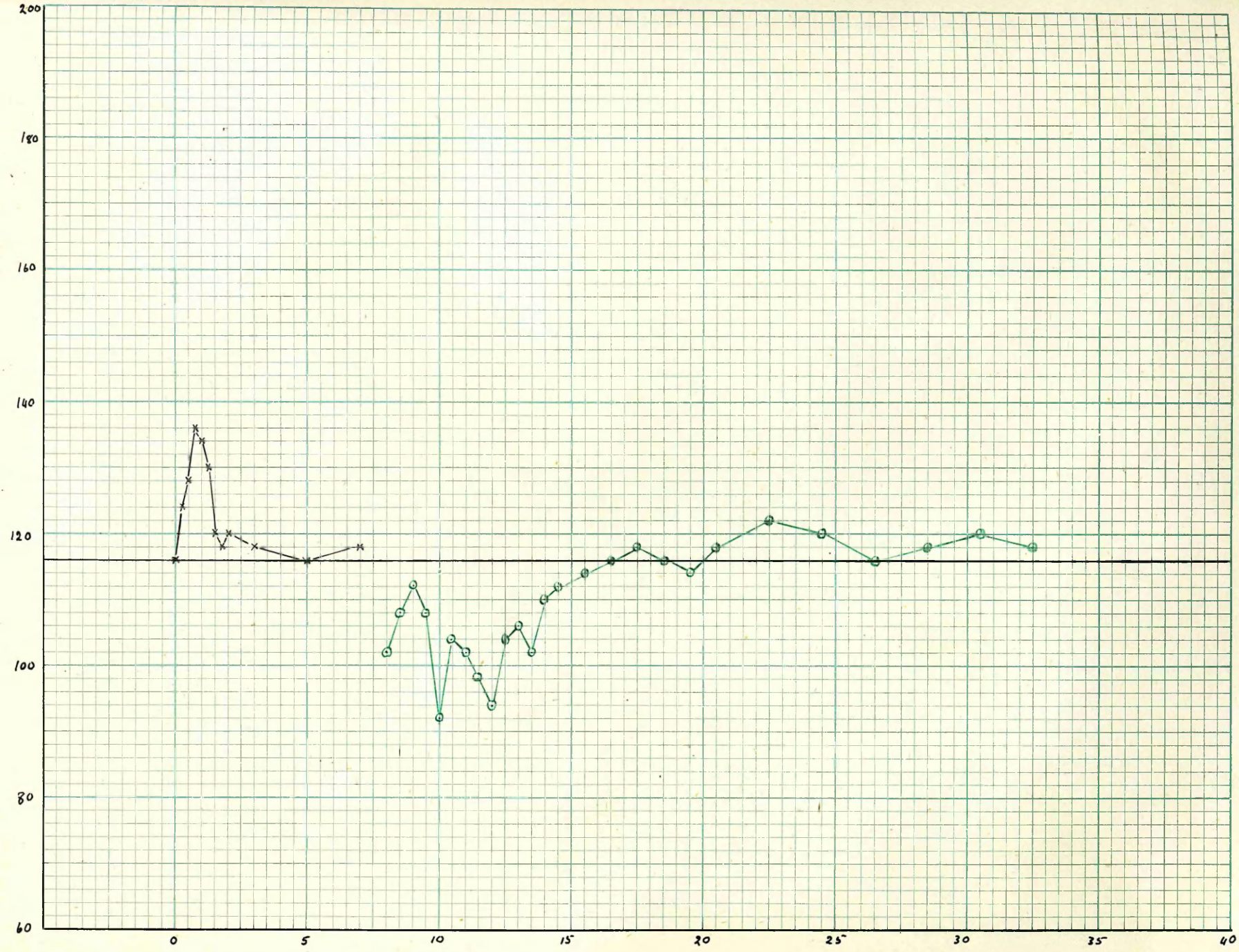
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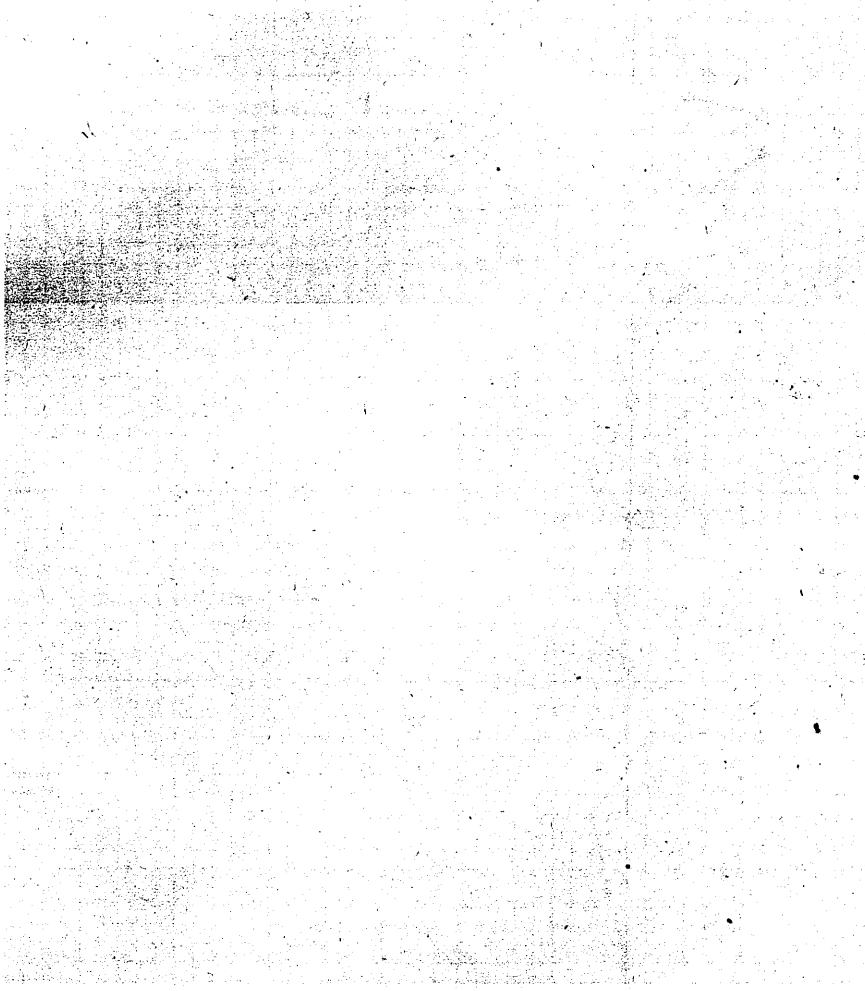
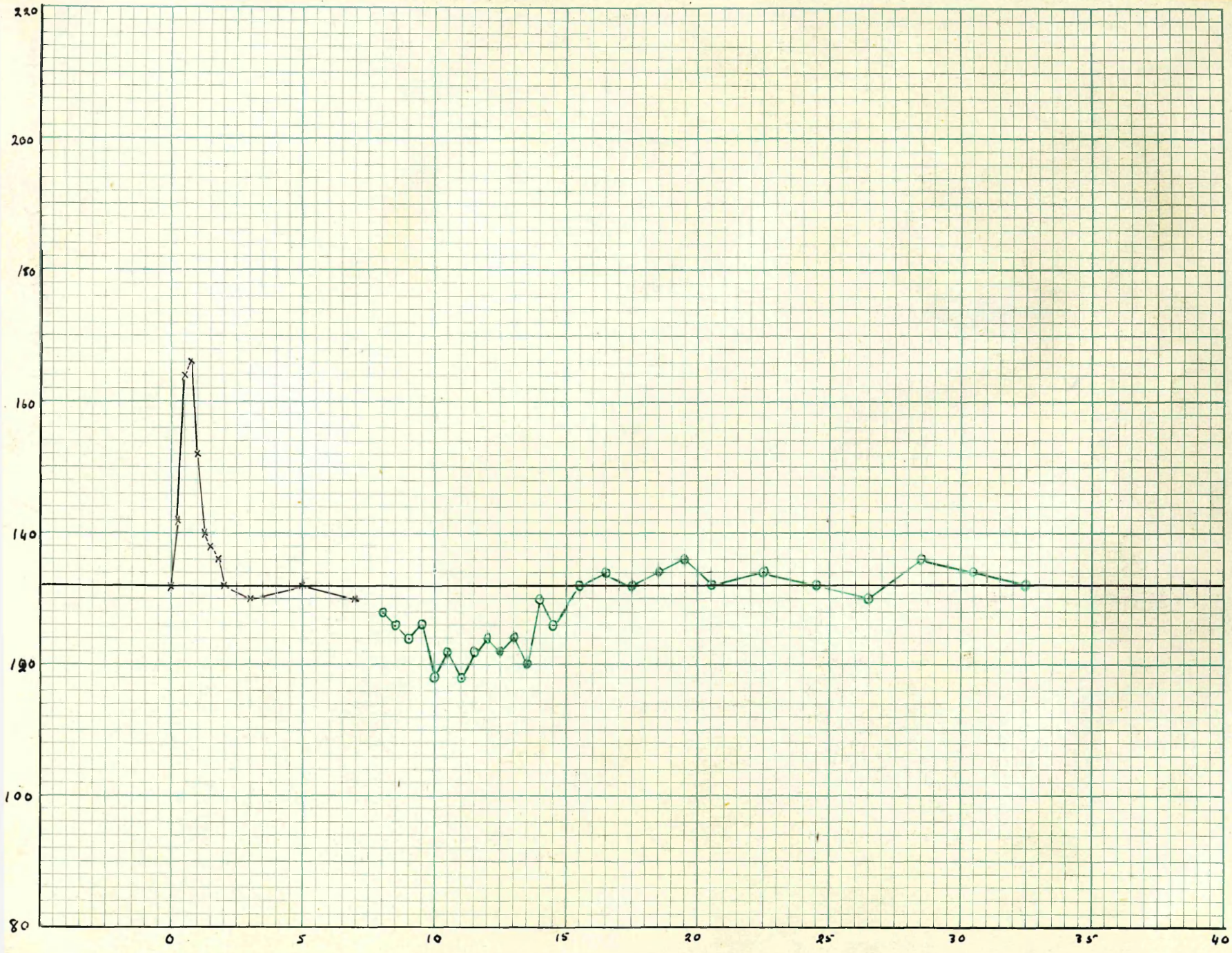
PERRY A DAY 14

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