

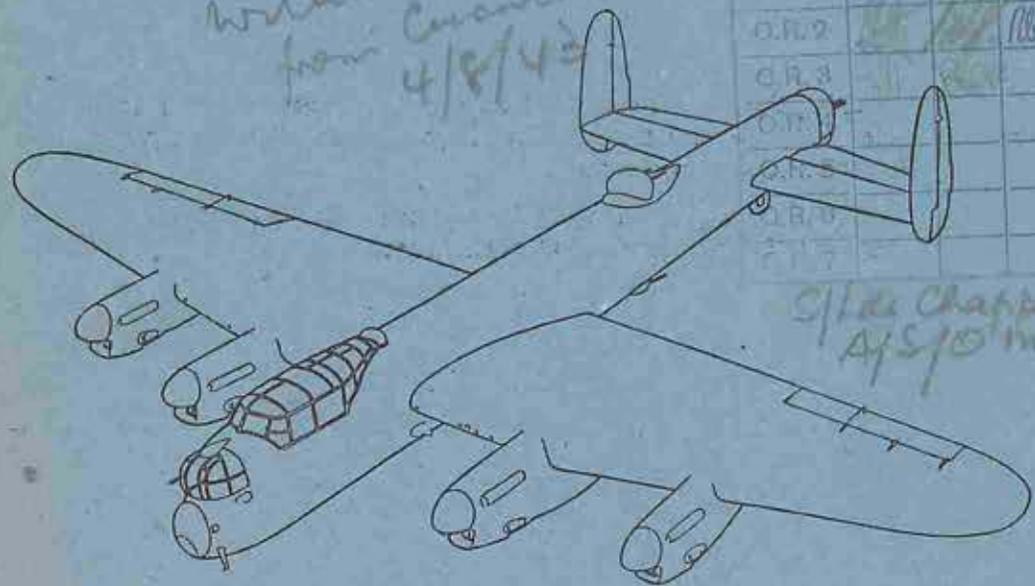
BOMBER COMMAND QUARTERLY REVIEW

1st July—30th September, 1942

No. 2

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DAMAGED WAR FACTORIES



FIG. 1.—The Thyssen Works at Hamborn (one of the largest steelworks in the whole of Germany and Occupied Europe) was seriously damaged by high explosive bombs in July, 1942. A heavy bomb burst in the heart of the huge rolling mill (right), destroying 150,000 square feet of roofing and much of the supporting structure. Other damage is outlined in the above photograph, and the effects on the working of the plant are referred to on page 4.

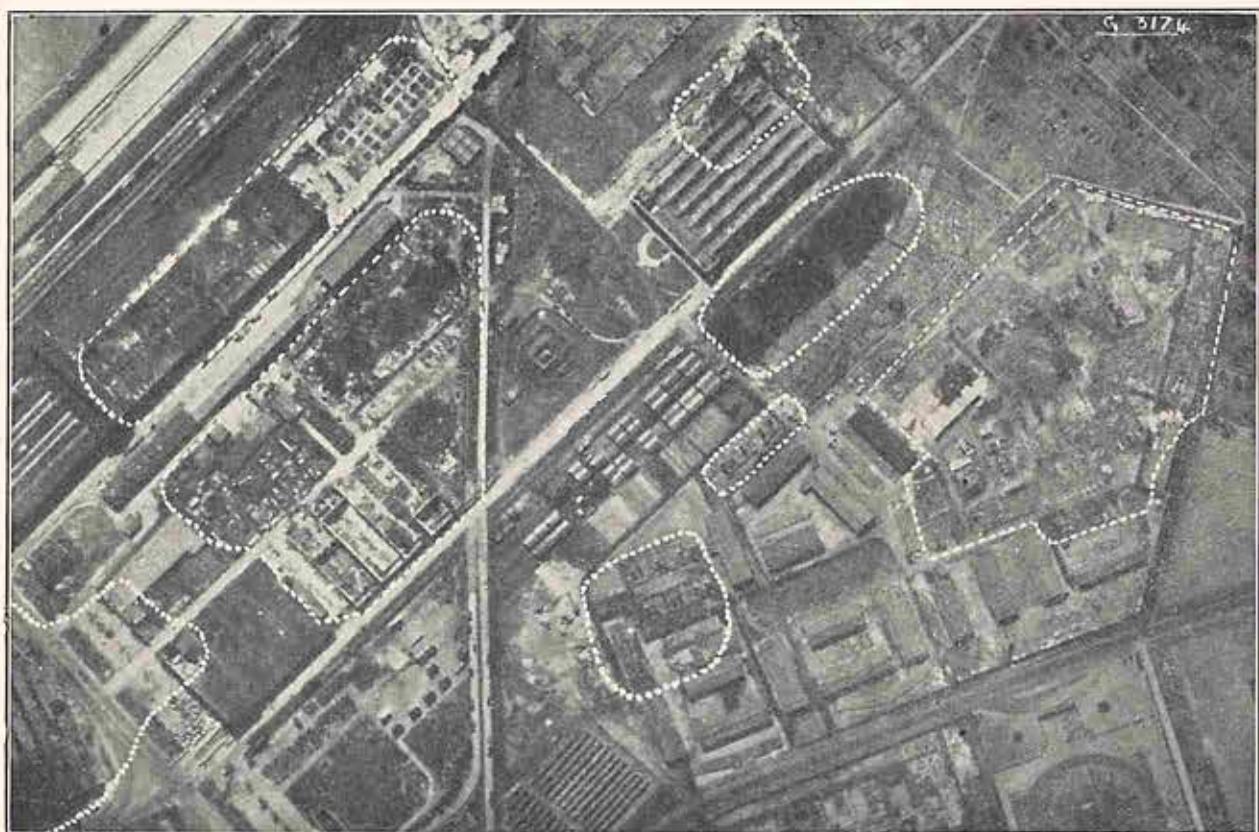


FIG. 2.—The Opel Works at Russelsheim, which manufactured armoured fighting vehicles and components on a big scale, was heavily damaged on 24th/25th August. The above photograph shows many workshops and stores buildings, covering an area of about eight acres, destroyed by fire or high explosive bombs (see page 7). The Opel depôt in Munich was severely damaged during the September raid on that city.

SECRET

**BOMBER COMMAND
QUARTERLY REVIEW**

1st July—30th September, 1942

No. 2

HEADQUARTERS
BOMBER COMMAND
ROYAL AIR FORCE

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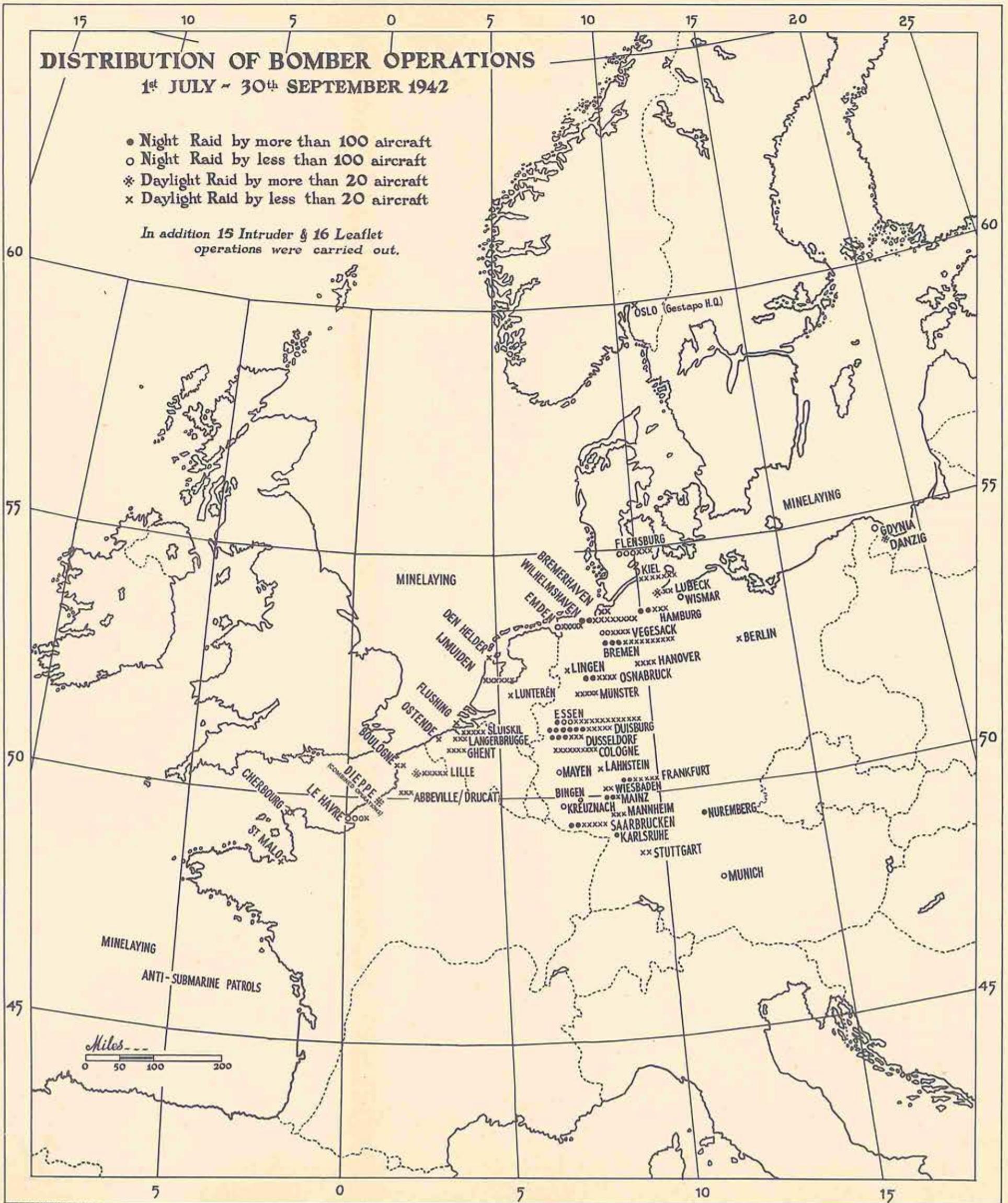
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DISTRIBUTION OF BOMBER OPERATIONS

1st JULY ~ 30th SEPTEMBER 1942

- Night Raid by more than 100 aircraft
- Night Raid by less than 100 aircraft
- * Daylight Raid by more than 20 aircraft
- x Daylight Raid by less than 20 aircraft

In addition 15 Intruder & 16 Leaflet operations were carried out.



I—THE BOMBER OFFENSIVE, JULY—AUGUST—SEPTEMBER, 1942

(a) INTRODUCTION

From 1st July to 30th September Bomber Command maintained an unbroken series of concentrated raids on the German Reich such as the enemy had never previously experienced. While no single operation attained the tremendous scale of the Thousand Raids of the preceding quarter, the weight of bombs dropped on German targets alone surpassed the total dropped on all targets during any other equal period since the beginning of the war. Had it not been for limitations imposed by weather this figure would have been even greater; but past experience has shown that bomber operations are least hampered by weather during the second quarter in each year, and a peak during this period is normally followed by a progressive decline until the succeeding spring.

A summary of the effort is given in the following table, from which it will be seen the weight of bombs dropped is 50 per cent. greater than in the corresponding period last year. This is partly due to the great increase in the proportion of "Heavies" and in part to more intensive operations, since the numerical strength of the Command was lower than in 1941.

	Approximate Proportion of Heavies.	Total Sorties (including mining).	Weight of Bombs dropped on Enemy Territory.
1941, July-September ..	10 %	10,629	10,900
1942, July-September ..	50 %	10,441	16,107

Photographic reconnaissance has shown that extremely heavy and widespread damage was inflicted on German war-potential as a result of these raids. The main features of this damage are reviewed in the following pages, but it can be said at the outset that many German ports and industrial towns have now suffered far more heavily than did any of ours during the bombing of Britain. The importance of this fact will be appreciated only if it is seen in relation to the strain simultaneously imposed on German industries, communications and popular morale by the life-and-death struggle in Russia.

How long Britain could have withstood the effects of German raids, had they continued at their greatest intensity, is a matter for conjecture; the effect of our present raids on Germany must inevitably be even greater in view of the vast wastage she is incurring on her 1,500-mile Eastern battle front. Our crews know very well that the present is the hour at which the Nazis can least bear our blows. "German people!" shouts Dr. Goebbels, "You know that this is your last chance . . ." It is therefore good to know that our bombing effort of the past six months has directly damaged Germany on a greater scale than ever before. The really outstanding characteristic of the period now under review was the regularity and effectiveness with which blow after blow was directed against a whole succession of key points in German war industry. In the nature of things a few of these blows missed the intended target—but even some of these misses achieved good effect. Taken by and large, the July-September blitz of 1942 was the worst thing the Nazi war plants have ever experienced.

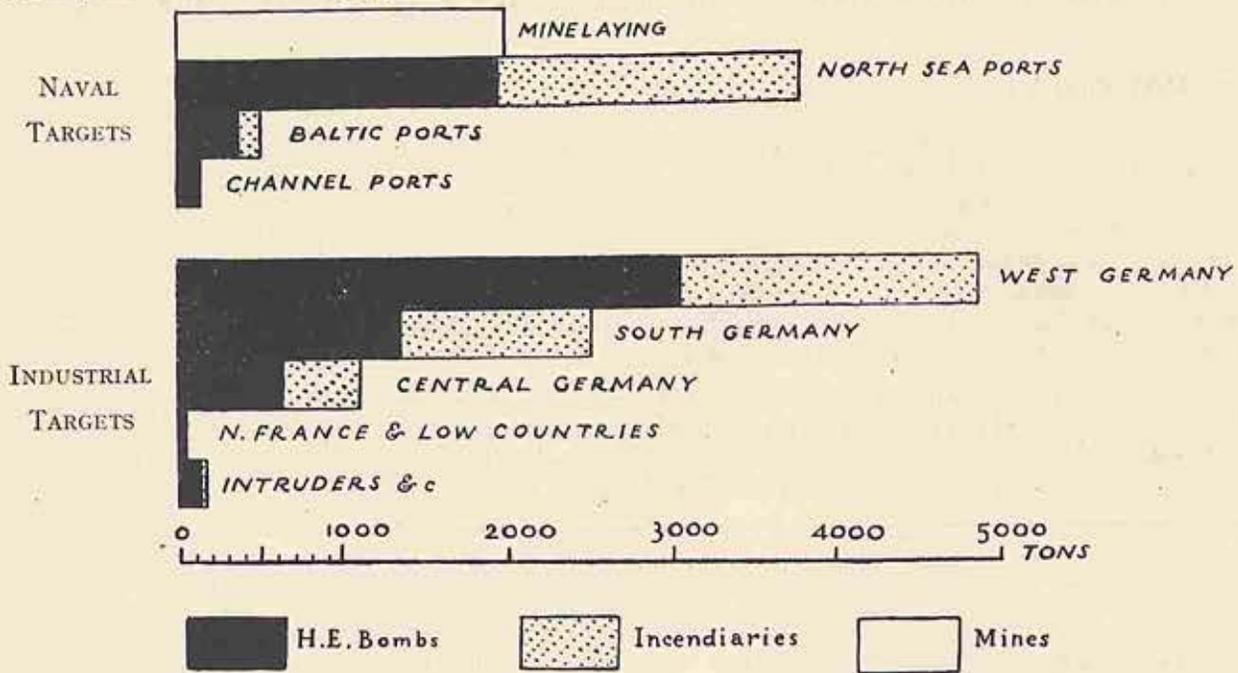
Moreover our bombers laid more mines along the enemy's sea routes than in any previous quarter. The record night occurred during September, when a very large number of mines were laid along the enemy sea-board from Bayonne in the south-west to the region of Königsberg in the Eastern Baltic.

Nor should it be forgotten that the quarter also saw the successful opening phase of the American daylight bombardment of occupied territory, while in the East the Russian bombers renewed acquaintance with Berlin and other cities which have, up to the present, been outside the orbit of our attacks.

Two important developments within the Command—the creation of a Pathfinder Force and the introduction of Air Bombers—occurred during the quarter. The purpose of the Pathfinder Force is well known, and while there is no doubt that the Pathfinder technique has led to an increase in the concentration achieved by our night bombers, much of this improvement must certainly be attributed to the cumulative effect of increased operational experience, to the development of new devices and tactics throughout the past six months, and particularly to the intensive development of night photography.

The introduction of Air Bombers was partly designed to relieve Navigators of a responsibility which often took them away from their plotting table at the most critical stage in an operation. Not only is it essential in many cases that Navigators should devote undivided attention to their specialised duties right up to the target: it is also desirable that the man who aims the bombs should be highly skilled in target recognition in the most difficult circumstances. For this task night adaptation of eyesight is an important requirement, liable to be upset by quite a small amount of light such as a Navigator cannot avoid using. The Air Bombers are one of the new developments which have helped materially to increase the proportion of our aircraft successfully attacking their objectives by night.

In the pages which follow, the operations of the last quarter are reviewed under two main headings—those directed against Enemy War Industry and those related to the War at Sea. The accompanying diagram illustrates how this effort has been distributed, and should be studied in conjunction with the tables printed below and on page 8.



(b) OPERATIONS AGAINST ENEMY WAR INDUSTRY

Although during last quarter no single industrial centre was shattered so extensively as was Cologne by the first Thousand Raid, Düsseldorf, Karlsruhe, Saarbrücken, Mainz, Nuremburg have all received damage on an exceptionally heavy scale. (At Düsseldorf and Karlsruhe the area of damage was proportionately greater than at Cologne.) Indeed, the aggregate of damage in those five cities alone exceeds one thousand acres and thus equals, if it does not actually surpass, the results of all operations against Germany during the whole preceding quarter—not forgetting the 600 acres devastated in the historic Cologne operation. The list of casualties to firms in the German engineering industry assumed truly impressive proportions and was, perhaps, the most outstanding feature of the quarter. As a result of damage to six major plants in the Düsseldorf and Duisburg areas alone, German war factories are deprived of some 1½ million tons of steel.

Nor was important industrial damage by any means confined to the cities mentioned above, as will be seen from the account which follows.

TABLE I
DISTRIBUTION OF EFFORT DIRECTED AGAINST INDUSTRIAL TARGETS
1st July–30th September

Targets in	No. of Sorties Despatched.	Tonnage of Bombs dropped in Primary Target Area.		Number of Operations.	
		H.E.	Incendiary.	By Night.	By Day.
<i>Western Germany :—</i>					
Düsseldorf	1,243	1,058	748	3	3
Duisburg	1,444	1,763	788	6	5
Essen	463	230	268	3	14
Other Targets	31	11	—	1	18
	3,181	3,062	1,804	13	40
<i>South Germany and Upper Rhine :—</i>					
Mainz	293	304	225	2	1
Saarbrücken	753	441	367	4	—
Frankfurt	480	348	417	2	5
Nuremburg	159	142	104	1	—
Munich	89	121	54	1	—
Other Targets	15	10	—	3	7
	1,789	1,366	1,167	13	13
<i>Central and North Germany :—</i>					
Kassel	306	258	239	1	—
Osnabrück	327	374	231	2	4
Other Targets	17	4	—	—	10
	650	636	470	3	14

TABLE I—continued.

Targets in	No. of Sorties Despatched.	Tonnage of Bombs dropped in Primary Target Area.		Number of Operations.	
		H.E.	Incendiary.	By Night.	By Day.
<i>Eastern Germany :—</i>					
Berlin	6	1	—	—	1
<i>Low Countries :—</i>					
Ijmuiden Steel Works	13	6	—	—	7
Sluiskil Explosives Works	7	3	1	—	5
Ghent-Terneuzen Canal (Oil)	6	1	—	—	4
Langerbrugge (Power)	5	3	—	—	3
Lunteren	12	—	—	—	1
	43	13	1	—	20
<i>France :—</i>					
Power Station Patrols	58	22	—	—	6
Boulogne Marshalling Yards	12	10	—	—	1
	70	32	—	—	7
<i>Other Operations :—</i>					
"Intruder" Patrols and attacks on Aerodromes in Germany and Occupied Territory	245	79	9	27	5
Combined Operation	89	51	10	—	1
Oslo (Gestapo H.Q.)	4	2	—	—	1
	338	132	19	27	7
TOTAL EFFORT	6,077	5,242	3,461	56	102

(i) The Ruhr and Western Germany

Düsseldorf.—This centre of iron and steel production on the Middle Rhine ranks high among German industrial targets. Prior to last quarter the people of Düsseldorf may have congratulated themselves on their relative immunity from serious air raids such as neighbouring cities had suffered. Suddenly their turn came, and Düsseldorf experienced a number of deadly night attacks comparable in effectiveness with those on the Baltic port of Rostock the previous quarter. But the comparison with Rostock is limited, as the size, structure and industries of the two cities are totally different. Central Rostock, consisting largely of close-packed, timber-framed buildings, was burnt out as a result of four concentrated incendiary attacks, while Düsseldorf's very extensive factory and commercial zones have a more solid character. It is estimated that in proportion to the total area of the city the damage here is even more serious than in Cologne.

On 31st July/1st August O.T.U.s joined in the successful mass attack in moonlight and good weather. Nearly 500 crews report having attacked targets in the city, releasing no fewer than one hundred and seventy 4,000 lb. bombs in addition to loads of smaller H.E. and incendiary bombs. Photographs taken with bombing show that the majority of crews correctly identified their targets, though a proportion of the effort fell to the westward, owing partly to the bombing of fires started by flares and incendiaries jettisoned by aircraft attacked by fighters en route to the target. Enemy fighters were particularly active under conditions which favoured them, not only in the target area, but noticeably so in the region of the Dutch coast on the route home. Losses were hardly higher than usual for targets in the Middle Rhineland, and our crews shot down many night fighters (*see page 14*).

Reconnaissance photographs taken over the city next morning showed more than 20 fires still burning, and extensive damage to important industrial and commercial buildings and in the riverside dock areas as well (Figs. 4 and 5). The most striking incidents included the wrecking of one of the largest machine-tool works in Germany, Schiess A.G. (Fig. 5, B), which also specialised in magnetic mines and bomb and shell components; while the main buildings of the Krieger Steel Works, the Deutsche-Rohrenwerke (rolling mills), the Limon-Fluhme Engineering Works, as well as several other steel and engineering works, all received severe damage resulting from direct hits by H.E. bombs. The Neuss Chemical Works were still on fire the day after the raid. Factories producing silica, alcohol and many other important requirements were among the casualties, and public utilities were seriously affected in numerous ways.

The second attack, on 15th/16th August, was on a much smaller scale, and was unfortunately hampered by cloud and poor visibility. Although night photographs show that some crews successfully bombed their targets, photographic reconnaissance for damage assessment purposes was not available until after the third raid, which was extremely effective.

This third operation (10th/11th September) was carried out by a strong force of between 400 and 500 aircraft led by the Pathfinder Force. The weather was fine but hazy, and this time there was no moon. Despite the haze and what was described as an enormous concentration of searchlights (which made it difficult to pick out precise aiming points within the target area), the raid was an outstanding success. In addition to previous damage, more than 100 acres of devastation were caused in the centre of the city between the Rhine and the main railway line. About 30 more factories, again including several iron and steel works and a chemical factory, were hit in Düsseldorf and the Neuss district on the opposite bank of the river.

Repairs being carried out on vital factories damaged in the first attack were nullified in many instances. The Rohrenwerke, for example, had to cancel a contract for 250 tons of gas and water pipes for delivery to Turkey owing to damage caused on 31st July/1st August, and repairs were still in progress when nearly seven acres of the main buildings were completely destroyed in the September raid.

The most impressive damage was probably the destruction of half of the imposing modern building of the main railway station by a direct hit on the main platform, which caused an extensive area of blast damage (see Fig. 5). At the time this incident occurred an express train had just arrived, and 50 passengers, including some leading industrialists, were killed. A letter written some weeks later by an inhabitant of Düsseldorf to a Swedish friend states: "The night train for Berlin is still standing at the platform—it was just starting when it got a direct hit and was crushed like a match-box." The same source revealed that not less than 190,000 people were rendered homeless in this attack.

In the Neuss district a direct hit on the junction of the Cologne, Aachen and Gladbach lines caused an area of blast measuring 1,600 square yards, while five railway sheds and the line to the Roundhouse were destroyed. The Main Tramway Depôt, the Telegraph Office and the State Observatory were among many prominent buildings destroyed or seriously damaged.

It is also known that a flat in the Königsring had all its windows blown out by a bomb which fell over 900 yards away—possibly one of the three 8,000 pounders dropped during this raid.

Towards the close of the attack our crews reported that the fires were furnace-like in intensity and aircraft flying at 8,000 ft. were enveloped in smoke.

Duisburg.—The great industrial concentration at the western end of the Ruhr valley, centred around the inland river-port of Duisburg-Ruhrort, was repeatedly and heavily attacked during the quarter: four times in July, and again in August and September.

The strength of the attacks varied, and so did the weather conditions under which they were made. The evidence of the night photographs and other indications confirm that 21st/22nd July was the most successful of these occasions, when about 250 aircraft bombed the target area within half an hour of the opening of the raid. Fires which were then started were clearly seen by many crews when crossing the North Sea coast on their return.

While the six raids did not result in vast tracts of devastation comparable with the attacks on Cologne, Rostock, Lübeck and other cities, the damage from numerous incidents in industrial and other property was widespread and severe. Large high-explosive incidents were especially prominent and, besides the heavy damage to the Thyssen Steel Works, 17 other industrial plants were affected.

The August Thyssen establishment, at Hamborn, is one of the largest steel works in the whole of Germany and Occupied Europe and produced millions of tons of steel and pig-iron every year for use in hundreds of arms factories. The finishing mill and steel strip mill had already been damaged on the 9th/10th March; but on 21st/22nd July a heavy bomb burst in the middle of the rolling mill and destroyed 150,000 square ft. of roofing and much of the supporting structure (Fig. 1). The point of impact was the junction of three types of roof which fact suggests a widespread area of destruction below, perhaps involving both the "breaking down" and "intermediate" sets of rolls. The replacing of the roofing alone is estimated to require several hundred tons of much-needed iron sheeting. The inability to work night-shifts until these roof repairs are completed is an important consideration—quite apart from the likelihood that one or more of the really vital parts of the mill were put out of action by the explosion. There are indications that the mill was four-fifths destroyed and that repairs would take at least six months to complete. This is a reasonable estimate in view of the fact that photographs on 1st August showed that damage done in early March was still in process of repair. In addition, the sheet melting mill was hit by a heavy bomb, 62,500 square ft. of the roofing stripped, and the greater part of the supporting structure underneath was destroyed. The power house roof also showed signs of damage.

The important N.O.M.A.G. engineering works at Neumühl also suffered severely in the July attacks. This is significant because it was engaged on the production of cranes, foundry equipment and bridge construction work. Many German cranes have suffered from our heavy blast bombs, and the former are now urgently required to repair serious damage inflicted on heavy industrial establishments.

The D.E.M.A.G. works at Hochfeld, too, was affected by these raids. This vital industrial concern produces (among other things) as many U-Boats in sections as the Blohm and Voss yards at Hamburg. At first it seemed unlikely that the damage which photographs showed to have been inflicted recently would cause a really serious loss of output; but it is interesting to note that certain goods on order for Japan were immediately removed elsewhere for safe-keeping. Moreover, it is now reported that 2,000 workers of the company are unemployed as a result of a stoppage caused by raid damage.

Five other steelworks in the Duisburg area received varying degrees of damage; a colliery was made unserviceable as a result of a direct hit which wrecked the pit-head buildings and equipment; a chemical works, a synthetic oil plant and many other factories in the neighbourhood all suffered considerably during the quarter.

THE CENTRE OF THE CITY OF MAINZ



FIG. 3.—The complete devastation of the centre of Mainz, caused during two successive raids in August, has no equal in any other German town. In addition eight military depôts as well as important factories and railway workshops were damaged or destroyed. (See page 6.)

HEAVILY DAMAGED DÜSSELDORF (See page 3.)

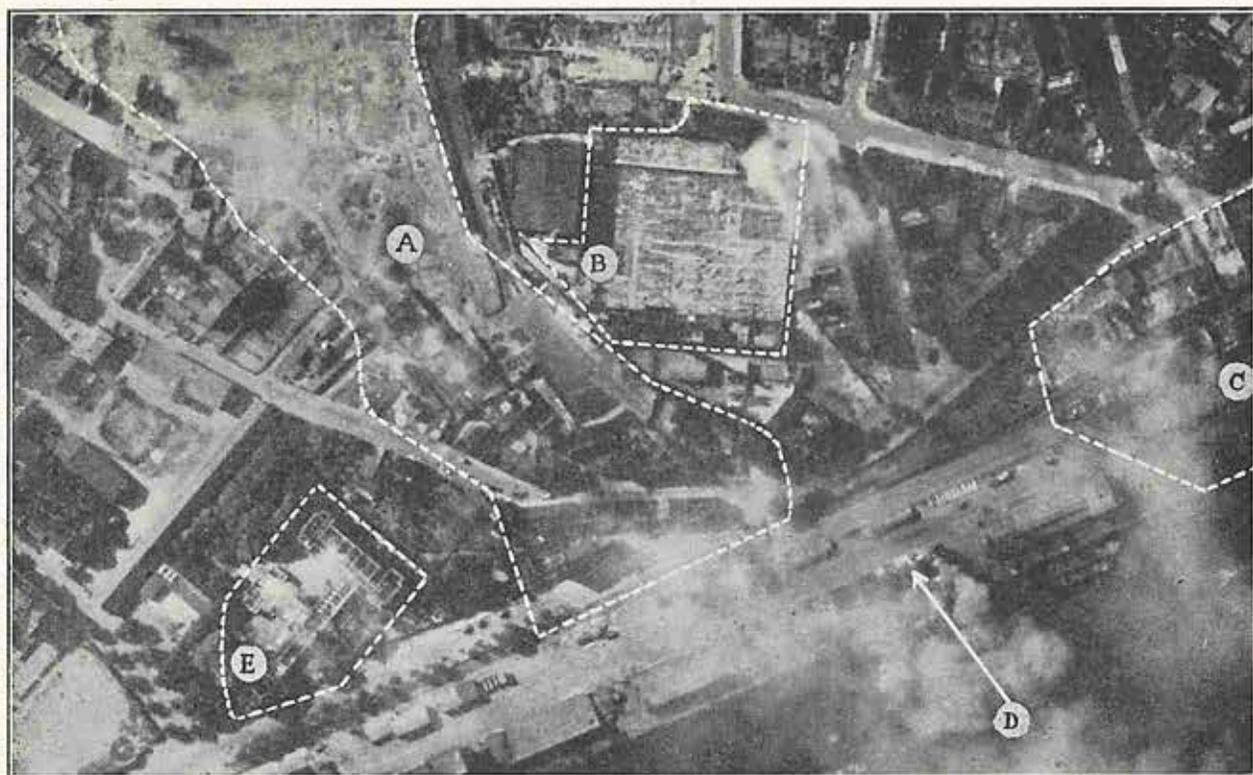


FIG. 4 (above).—The dock area still burning the day after the first big raid on the city, 1st August, 1942.

- A—Twelve acres destroyed.
- B—Worsted mill destroyed.
- C—Many warehouses gutted.
- D—Customs House on fire.
- E—Large building gutted.



FIG. 5.—Three large incidents of vital damage in one part of Düsseldorf. (Photo, left.)

A—The Deutsche Rohrenwerke (steel works), the greater part of which was completely destroyed in the September raid.

B—The largest machine-tool works in Germany (Schliess A.G.), which was extensively wrecked by a heavy H.E. bomb in July. Some repairs were put in hand, but further damage was inflicted in the September attack. This works manufactured magnetic mines, bomb-cases and heavy shells as well as machine tools.

C—The main railway station received a direct hit which wrecked half of the main block of buildings and caused a hole in the roof over the platform measuring more than 100 yards in length.

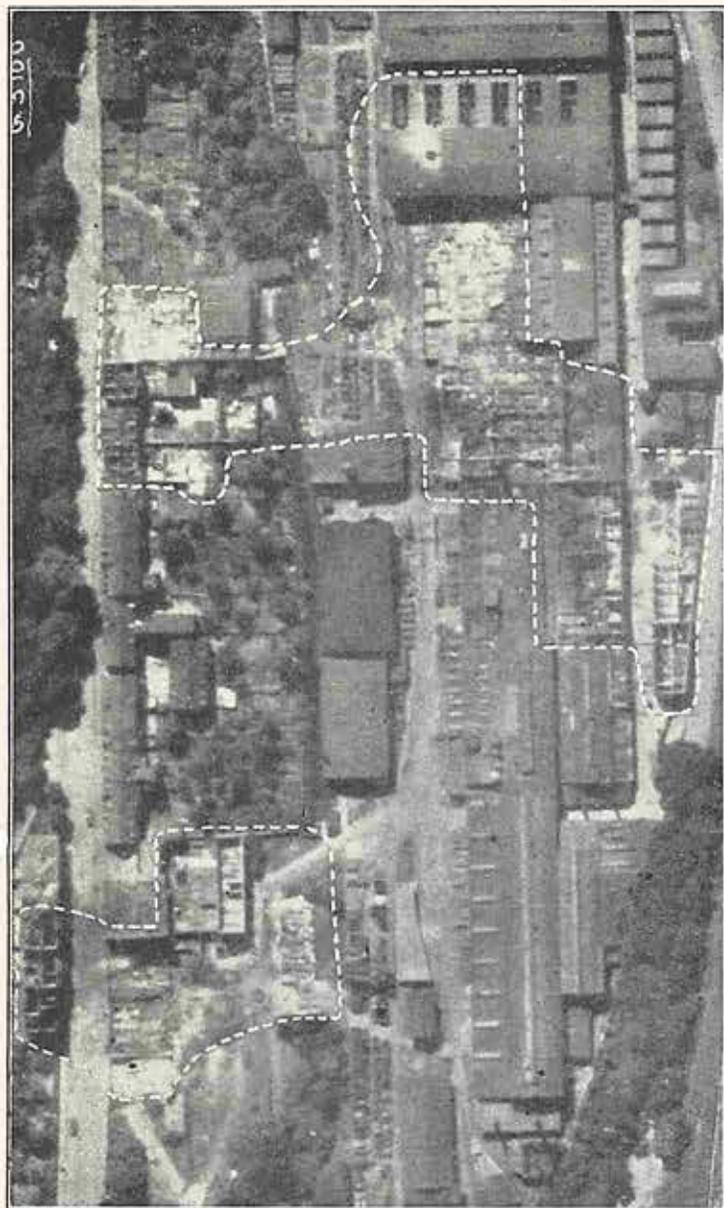


FIG. 6.—A quarter of the Ehrhardt and Schmer engineering works was destroyed in the first heavy attack on Saarbrücken at the end of July.

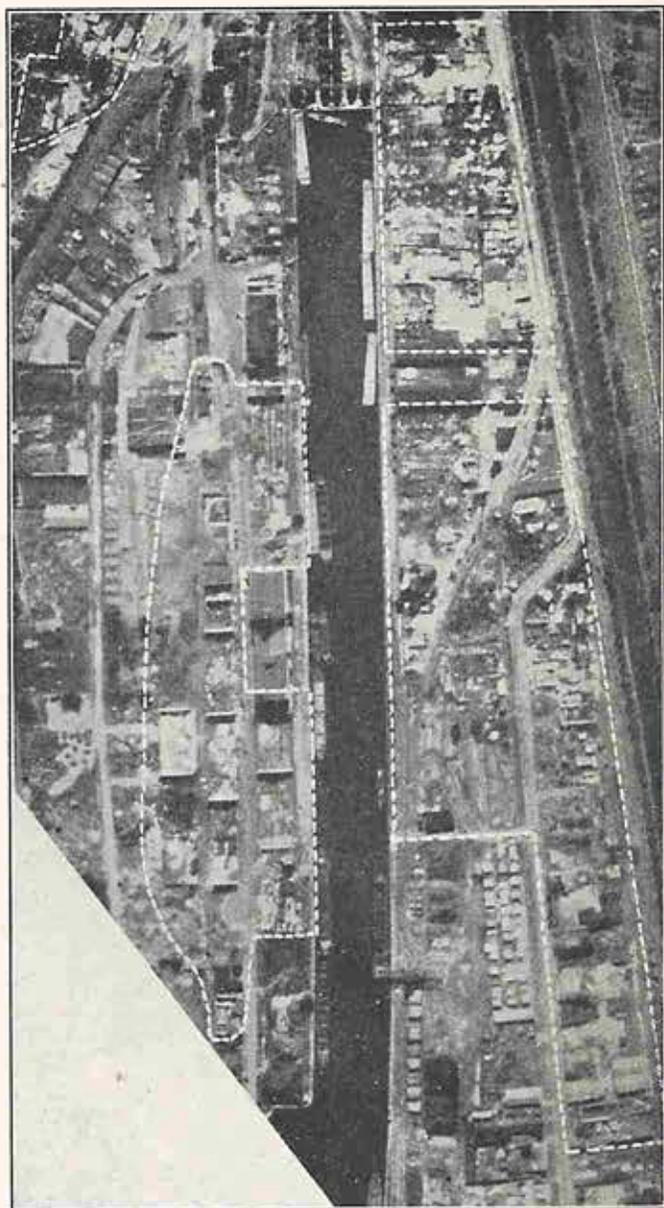


FIG. 7.—Osnabrück: some 40 warehouses and dock stores buildings (covering some 25 acres in the Kanal Hafen) were completely burnt out in August.

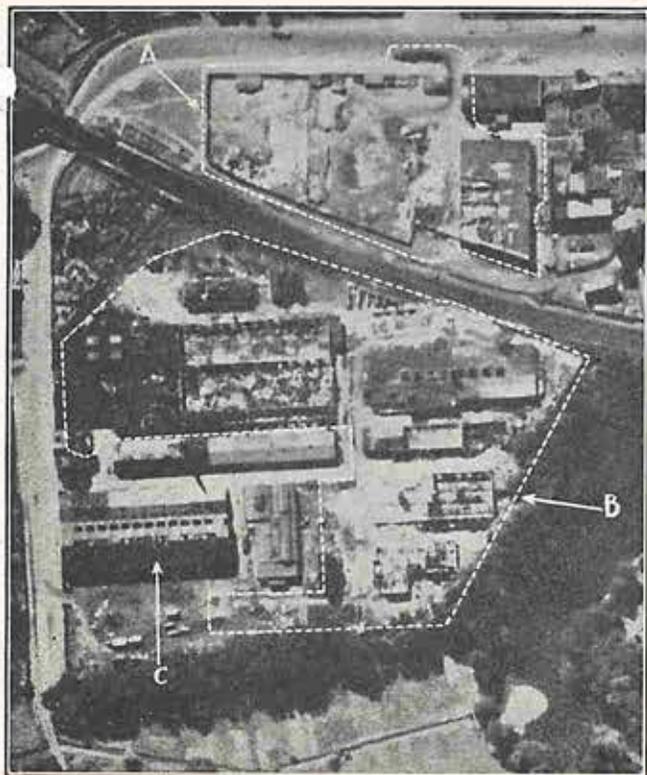


FIG. 8.—Nuremberg: A—Large factory gutted. B—Metal works completely destroyed. C—Workshop with damaged roof.

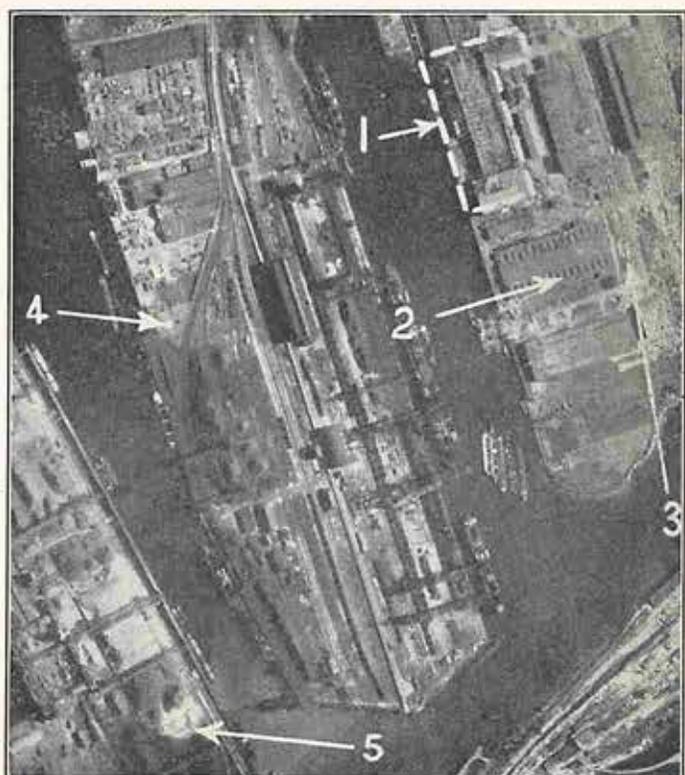


FIG. 9.—Bremen Docks: 1—Weser Airframe Works, machine shop almost completely destroyed. 2 and 3—Further points of damage. 4—Crater. 5—Hit on the coaling wharf.

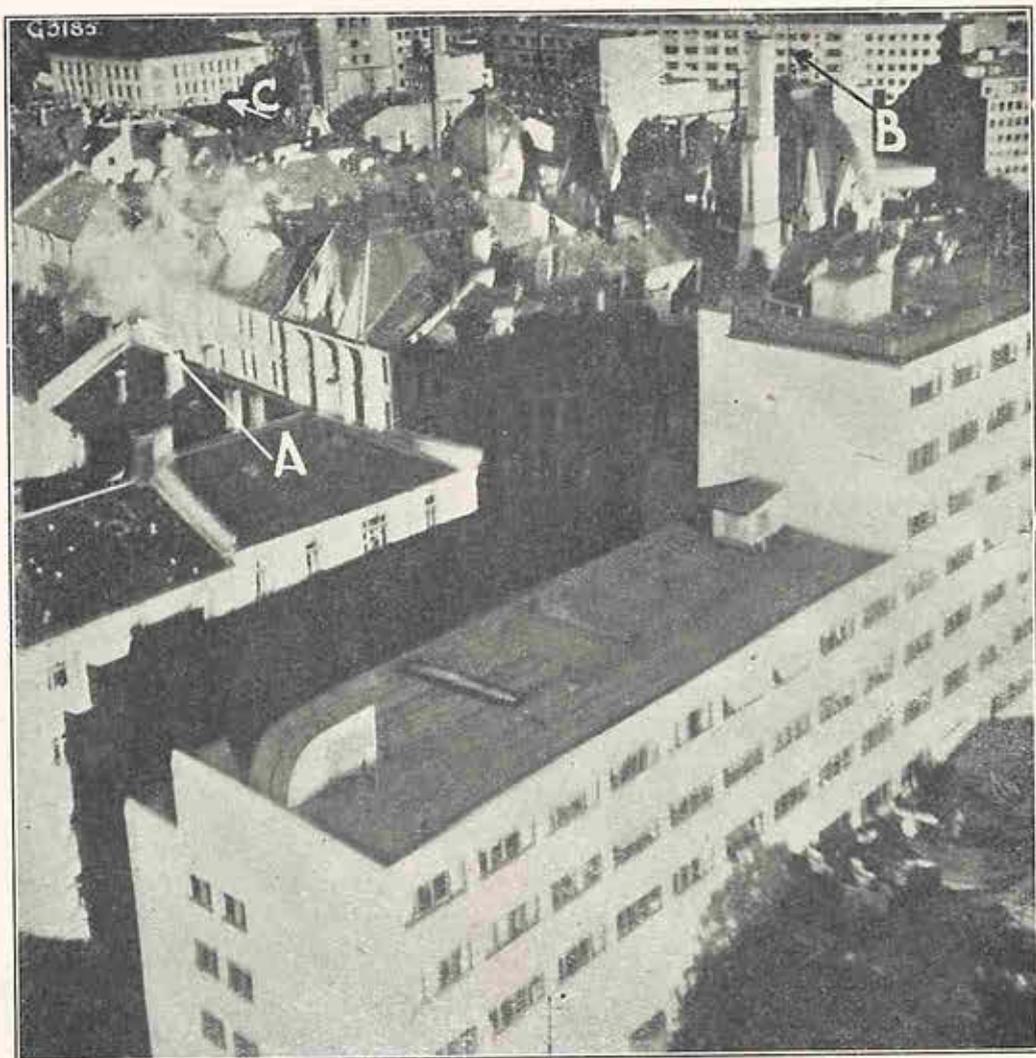


FIG. 10.—DAYLIGHT ATTACK ON THE GESTAPO H.Q., OSLO, 25TH SEPTEMBER.

A remarkable photograph taken astern by the leading Mosquito as it flew away from the building just clearing the roof tops. (See page 13.)

A—Smoke and dust from a direct hit on the Gestapo building, before the delayed-action bomb exploded.

B—The central cupola on which the Nazi flag was seen by the crews.

C—The University in the background.

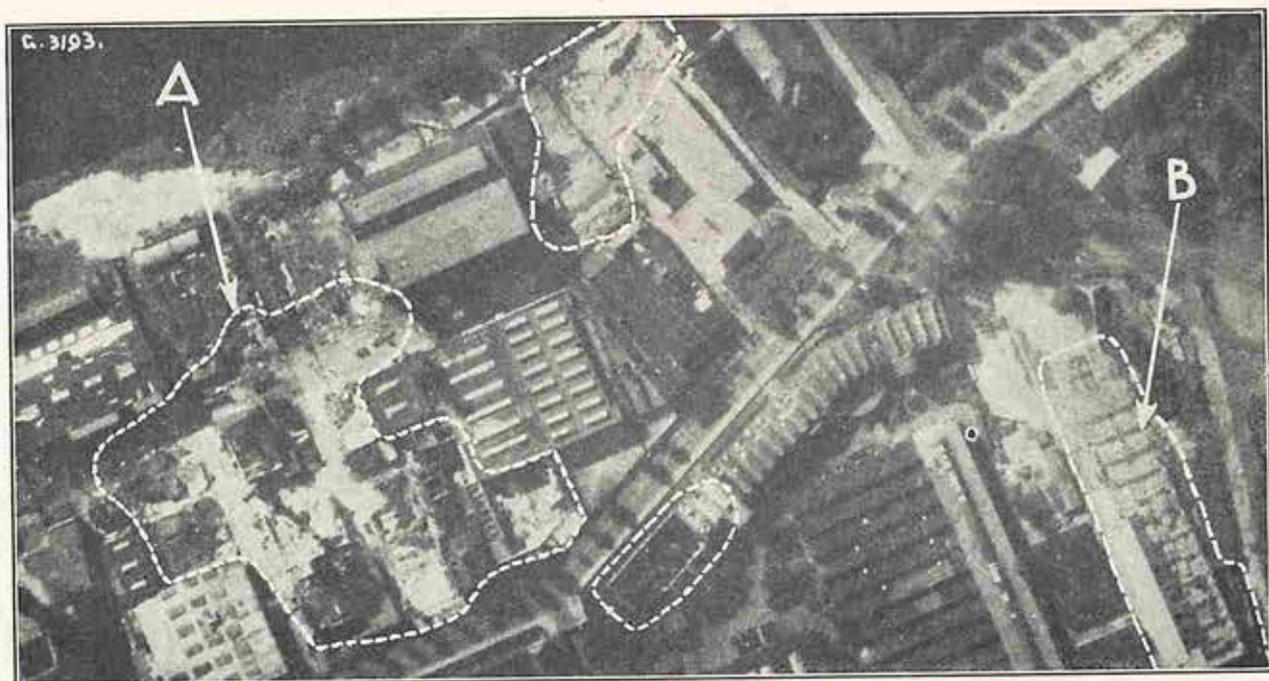


FIG. 11.—BREMEN. A damaged factory area in Hemelingen on the bank of the Weser. A—The Lloyd Dynamo works; severely damaged, many shops being demolished. B—A very large building in the Borgward works completely gutted. This works manufactures armoured fighting vehicles and motor transport. (See page 9.)

Furthermore, the installations of the great Duisburg-Ruhrort docks, including railway sheds and dockside warehouses, were badly damaged. This is the world's largest river port, and handles far more goods than Hamburg. Not less than about 90 barges engaged in river goods traffic, and the French tug *Nantes*, were sunk during the last attack, making the harbour unserviceable for a time. This loss, together with similar instances reported from other raided towns on the Rhine, must have added to the ever-growing transport difficulties of the Reich. An official circular reflecting this position begins thus:

“ Protection of Inland Shipping Against Air-Raid Danger

“ It has been found that during various air raids incendiary bombs have caused vessels to sink by piercing clean through the bottom. As from now every ship must carry in readiness a number of wooden plugs, of various sizes, in order to repair any such damage by bombs by plugging the holes immediately.”

To add further to the troubles of this key point of Ruhr and Rhineland communications the main station at Duisburg was also hit, though not as severely as many important stations in other German cities. The cumulative effect of such damage may be judged from the report that the July raids dislocated the coal traffic to Italy for a week.

Essen.—One heavy night attack was directed against this difficult target during the quarter. The night was dark when crews reached the Ruhr and a high wind failed to disperse the familiar haze. Photographs taken during the attack show that the effort was rather scattered, but about a third of the force appear to have reached the vicinity of Essen—two Lancasters of No. 5 Group being plotted right over the centre of Krupp's works. This compares very well with the evidence for previous operations and suggests that the attack achieved a greater concentration around the primary target than any other against Essen. Without photographic reconnaissance it is not possible to assess the damage inflicted, but reports by crews who obtained photographs of the target area indicate that the few scattered fires at first seen in the town increased as the attack developed, culminating in several large fires and a great explosion near the end of the raid.

Some crews unable to pinpoint Essen succeeded in attacking industrial objectives, for instance, at Hamborn and the marshalling yards at Wedau near Duisburg.

With regard to earlier attacks there are now indications that the thousand bomber raid on Essen last June did more damage to the town than was at first believed. Working-class districts at Altendorf and the Kolonie Kronenberg are stated to have suffered extensively in addition to the considerable destruction elsewhere in the town and in other nearby industrial areas reported in the first issue of this Review.

(ii) South Germany and the Upper Rhine Area

Saarbrücken experienced its first bombing attack during last quarter. The raid of 29th/30th July is regarded as one of the most successful first attacks carried out on any area in Germany. Nearly 300 aircraft took part, and the losses were unusually low.

Identification of such an inland target on a cloudy night was not easy, but a bright moon helped considerably and visibility was good. The two main factories were severely hit and in one, the Dudelinger Iron Works, there were over 20 items of damage: many sheds in the rolling mills and elsewhere were destroyed or damaged. There were hardly any roof lights left in any of the factory buildings, and at the time of P.R.U. reconnaissance the Works appeared completely inactive. The mills are known to have been producing armour-plate for tanks in addition to their normal forgings. Gas from the coke-ovens supplied the town and was also fed into the Saar grid.

The other very important factory, the Ehrhardt and Schmer Engineering Works (Fig. 6), was one-quarter destroyed by H.E. Bombs. 1,400 hands were employed here to produce diesel, gas, and steam-engines, and the destruction of 140 houses in the adjacent workers' settlement will doubtless have helped to keep the plant out of action for a considerable time.

About half the buildings of the main goods station were destroyed. Sixty-eight passenger coaches and many goods trucks were destroyed or damaged in the vicinity, and the locomotive shops—a most important target in view of Germany's acute shortage of locomotives—were seriously damaged.

A large number of smaller factory, commercial, and residential buildings were damaged or demolished.

Adolf Hitler Strasse was particularly unfortunate, as the offices and shops which flank it on either side now constitute one of the major areas of destruction in the town. Four thousand pound bombs did extensive damage easily seen on photographs, and they must have shattered windows over a very wide area since the Press reported the arrival of “innumerable” glaziers from many towns in S.W. Germany. One newspaper editorial declared that “the raid was an agony for the Saar people and they will remember it for ever.” Some 10,000 people were said to have become homeless as a result of it.

It is interesting to note that a concentration of railway flak appeared at Saarbrücken immediately after this raid: 12 heavy and 11 light flak wagons being distributed round the town.

The next night operation directed against Saarbrücken, on 1st/2nd September, fell mainly on the district of Saarlautern, which suffered an extremely concentrated raid by about 200 aircraft. Complete devastation must have been inflicted here, but the area has not been fully covered photographically since the raid. On the edge of it, and at the suburb of Fraulautern, much damage was seen to have been caused to a number of factories and also to residential property. At Saargemund

a converted works now producing shells was severely damaged and a parachute factory was burnt out. Some 60 families living next to this works lost their homes and all belongings; and barracks in the neighbourhood were heavily damaged.

On 19th/20th September a rather smaller force caused some further destruction in the scarred Saarbrücken area, although the weather was not nearly so favourable in this region as it was at Munich, which another force of our bombers attacked on the same night (*see* page 7).

The raids on the Saar region are believed to have had a very important effect on industrial production which could not be ascertained from photographs; many ventilation shafts in the coal-mining areas have been damaged or fallen in. Repairs will take a considerable time, and in some cases the damage has resulted in a complete suspension of all work in mines served by these shafts.

This is a good example of incidental damage caused by our heavy raids on German industrial areas. That such occurrences—including, for instance, the destruction of gas, water and electricity mains—are not uncommon features of a heavy attack we know from our own experience in this country. Indeed they may be even more damaging to production than those incidents, such as a direct hit on a steel rolling mills, which look so impressive on a photograph.

It is now considered that as a result of recent raids the coal production of the Ruhr, Saar and Aachen districts has fallen off by 80,000 tons per day—that is, nearly 20 per cent. of the former output. At the Rhein-Preussen mines alone output dropped by 25 per cent. owing largely to damage to workers' dwellings in the neighbourhood.

Karlsruhe.—Two hundred aircraft set out to attack this target on 2nd/3rd September, led by the Pathfinder Force. In excellent weather a very high proportion found and bombed their objectives, leaving behind them great fires and columns of smoke 9,000 ft. in height. This was undoubtedly one of Bomber Command's most successful operations, and reconnaissance showed that some 360 acres in the built-up area were destroyed. That is the equivalent of half the devastated areas resulting from the Thousand Raid on Cologne.

Although Karlsruhe is not to be compared in importance with Cologne, it contains a number of engineering works as well as many other valuable industries, and the Rhine harbour and Marshalling Yards to the south-west of the town are key points in the transportation system of the Upper Rhine area. This part of the town received much attention, and 60 acres of industrial buildings, and yards were devastated. The harbour itself was seriously damaged, many silos burnt out and cranes destroyed. It is also believed that 500 trucks of coal on the harbour sidings were destroyed, as well as 12 locomotives. The railway workshops south-east of the town had a number of sheds damaged or destroyed. A very large coke storage depôt was still burning nine days after the raid, and it is said that 900 tons of coke were destroyed despite strenuous efforts to put out the fire.

On the aerodrome a barrack block and a hangar were demolished, and other buildings damaged, while a military barracks also suffered heavily. In a large factory producing fire-fighting equipment buildings covering no less than 14 acres were destroyed.

Three-quarters of the town was still without electric current five days after the raid owing to the partial destruction of the main generating house of the Power Station. The largest area of devastation includes the destruction of no fewer than 11 blocks of flats. Newspapers stated, no doubt quite truthfully this time, that thousands of people lost all their property within a few hours and there were signs of panic on several occasions. An official notice contained the following revealing comment:—

“It is natural that the great strain of the night of horrors did not pass without leaving its traces on everybody; it is understandable that some nerves did not quite stand the strain.”

With the destruction of the Police Headquarters, the Food Office, the Main Post Office, and the Regional Treasury, the population must have been slow in recovering from this exceptionally heavy blow.

As an illustration of the repercussions which such a raid can have, it may be mentioned that the population of the nearby town of Freiburg were considerably alarmed at the prospects for their own future. Large numbers spent the night after the Karlsruhe raid in the depths of the Black Forest.

Mainz.—The capital of the province of Rhenish Hesse has a population of about 150,000. It is partly industrial, but is also a garrison town and an educational centre. The first raids on this target took place on 11th/12th August and the following night, and the weight of the attacks fell with devastating effect on the centre of the city. The leading crews attacking the target on the second night could see the glow of fires started in the previous attack. Besides the destruction by fire of a large number of public buildings and commercial and residential areas, an important feature of the raids was the destruction caused in four military barracks in the town and suburbs, and in two military depôts. It is believed that there were about 800 field guns and limbers in the Kastel depôt at the time it was bombed.

In addition, warehouses and railway workshops at the main goods station and the South Station were destroyed; and in one district 4½ acres of railway sheds, warehouses and offices were gutted by fire, and two oil transport trains are considered to have been burnt out. A shipbuilding yard, chemical works, cement works, and other factories were considerably damaged by high explosive or incendiary bombs, while 24 barges laden with coal were sunk in the Rhine during the second raid.

The central area of Mainz (Fig. 1) is perhaps the most striking instance of devastation to be seen in any German town. More than a quarter of the population, 40,000 people, were evacuated to other towns.

Frankfurt was another German town selected for heavy attack for the first time during last quarter. A heavy raid was launched against it on 24th/25th August, under the leadership of the newly established Pathfinder Force. On this and the next occasion (8th/9th September) much cloud and haze prevented a formidable concentration being achieved on the primary target, but photographs taken by P.R.U. confirmed that damage was inflicted in several parts of the city. This damage was admitted by the Germans. In one district an area of four acres west of the Festhalle, including two imposing warehouses, was completely devastated by fire. But the most important damage revealed in the areas covered by photographic reconnaissance after the raids was at Russelsheim, which was attacked by a large proportion of the force unable to identify Frankfurt on the second night. Here excellent results were achieved, as the Opel Works which manufacture armoured fighting vehicles and components on a big scale had been hit repeatedly; next to the railway which serves the works, an area of about eight acres was destroyed by fire, many workshops and stores buildings were burnt out, or damaged by blast, and one large workshop had a direct hit (Fig. 2). At Bischofsheim (also attacked in the second raid) the marshalling yards were hit in a number of places, affecting four tracks, and two railway buildings were seriously damaged by high explosive.

The large chemical works (I. G. Farben) at Höchst were attacked by another section of the force on 8th/9th September; five buildings in the western part of the works were destroyed of which two were large laboratories, and the others engaged in producing chemicals required for various war and industrial processes.

Nuremberg.—The first really successful raid on the city favoured by the Nazis for their Annual Rally took place on the night of 28th/29th August. Apart from six main areas and many smaller patches of destruction in all parts of the city, amounting to more than a hundred acres, there were numerous incidents of damage to industrial concerns (Fig. 8). At the M.A.N. Works, a workshop covering nearly 25,000 sq. ft. was completely destroyed, another building 250 ft. in length was partly demolished and several others were damaged. This engineering establishment is, of course, one of the great "triangle," of which the principal works, at Augsburg, was the target successfully attacked in daylight by Lancasters last April. A large building in the Siemens Schuckert Works was completely destroyed; and at the aerodrome a large hangar and two workshops were damaged. One 4,000 lb. bomb demolished sheds and houses over an area of some 8,000 sq. yards, while two other H.E. incidents caused damage over $3\frac{1}{2}$ and $1\frac{3}{4}$ acres of built-up area respectively; one area of burnt-out houses extended over 10 acres eastwards of the Main Station. Small wonder that the Mayor was obliged hurriedly to call managers of all building firms to conference after this damaging raid.

Munich.—It was an event likely to impress the Germans that the far-off Bavarian capital (the home of the Nazi movement) should be quite strongly attacked on the same night that another force of about a hundred aircraft bombed the Saar. Munich is as far from our home bases as Berlin and Leipzig.

Damage in Munich was spread mainly over the centre and southern half of the city. The most notable incident affecting war output was the complete destruction of the Baumann Engineering Works as a result of a direct hit from a 4,000 lb. bomb. There are indications that the Kustermann Ammunition Works was partially destroyed and that the Opel armoured vehicle dépôt was severely damaged. The B.M.W. Aero-Engine Works and a railway workshop engaged in mounting heavy calibre guns are also stated to have been hit. On the east bank of the river the explosion of two dry-type gasholders was indicated by the photographs, while a tram dépôt was seen to be partly demolished. Commercial and residential property suffered considerably; in one district alone an area of $5\frac{1}{2}$ acres was devastated. Casualties were said to be heavy.

The destruction of the Rosenberg Temple must have caused a great stir, as this prominent building is believed to be the headquarters of the National-Socialist Cultural Fraternity. Another well-placed bomb wrecked the buildings housing the Nazis' "New Europe" Exhibition. The well-known Volkstheater, near the Main Railway Station, "closed temporarily" according to a Press announcement after the raid, and tickets for a star performance had to be refunded.

As a result of conditions arising from the attack, the Gauleiter of the region ordained that the Nazis' Party Day and all its meetings would be cancelled.

(iii) Central Germany

Kassel.—With the recent change in German war production policy, giving higher priority to railways, the Henschel Works at Kassel became one of the most important industrial objectives for our bombers. Locomotive and railway wagon construction has now a priority equal to that of aircraft, tanks, and U-Boats—since it is openly admitted by the German leaders that the existing rail transport was unequal to the strain imposed by the first winter of their Russian campaign. Hitler hopes to more than double his locomotive production, and Henschels, the biggest locomotive concern in Germany, plays a great part in his scheme.

Bomber Command made a direct onslaught against the great production centre at Kassel on 27th/28th August. Over the target area the strong force had to contend with much haze and a certain amount of cloud which undoubtedly prevented some crews from identifying their target. But a good number succeeded and managed to score several hits on their main objective, the Henschel factories. The largest factory building of the three Henschel works was damaged by fire while, of several others which suffered, some were partially destroyed. There are indications which suggest that this attack will cause a production loss of 30 locomotives a month.

A large railway station (Niederzwehren) was damaged and all the buildings in the sidings demolished and nine factory buildings in three places in the town were destroyed. Much residential damage was caused, among which there were a number of very heavy H.E. incidents. In one street a complete road frontage of 130 yards in length was gutted.

Osnabrück was twice attacked in August, resulting in particularly useful damage at the Canal Harbour, where an area of 25 acres, including nearly 40 warehouses was devastated (Fig. 7). Photographs show the results of incendiary fires scattered over the whole of the town. Three factories suffered as well as public buildings, and some 200 other buildings were destroyed.

Useful railway damage was achieved here, too; the main building of the Goods and Shunting Station was partly demolished, while 750 ft. of railway warehouses and sheds, including a workshop, were gutted.

Much of this damage occurred during the second raid (17th/18th August) which was somewhat unusual, in that the plan of attack provided for an interval of half an hour after the first wave of aircraft had left the target area to allow the fires to take hold before the second wave added their contribution. Undoubtedly, this procedure had a salutary effect on fire-fighting organisations.

(iv) Daylight Attacks on Industrial Targets

In addition to the daylight attacks on ships and naval building-yards which are discussed in the next Section, many small-scale daylight operations were directed against industrial targets in occupied countries and also well within the territory of the Reich. Mosquitoes of No. 2 Group were used extensively on cloud-cover raids over wide areas of Northern and Western Germany. Not infrequently cloud cover gave out before the target was reached, but in spite of this the raids must have set off the warnings in a good number of industrial areas, and are thus likely to have interfered with production to some extent. But a number of aircraft succeeded in obtaining direct hits on primary or alternative targets in Germany, including power stations at Knapsack (Cologne) and at Stolberg, near Aachen, while one Mosquito bombed Berlin from 20,000 ft. Four Mosquitoes ordered to attack a Chemical Works at Wiesbaden (some 100 miles S.S.E. of the Ruhr) did so without cloud cover and, because of failing light, released their bombs from a relatively low level in a shallow dive from 4,000–2,500 ft. The works received at least one direct hit by an H.E. bomb and several sticks of incendiaries struck home; as the aircraft set course for base they had the satisfaction of seeing black smoke rising from their target. None of the Mosquitoes received any damage during this operation.

In Occupied Territory, Bostons kept up their tour of power stations particularly in the Lille area, and varied the routine by successful attacks on oil installations, chemical and steel works, and also joined forces with the U.S.A.A.C. in effective attacks on Abbeville-Drucat aerodrome. Mosquitoes attacked such targets as the iron and steel works at Ijmuiden with excellent results, and added to the damage which the Bostons had previously inflicted on the Sluiskil Chemical and Explosives Works, in Holland.

TABLE II
DISTRIBUTION OF EFFORT DIRECTED AGAINST NAVAL TARGETS
1st July–30th September, 1942

Targets in	No. of Sorties Despatched.	Tonnage of Bombs dropped in Primary Target Area.		Number of Operations.	
		H.E.	Incendiaries.	Night.	Day.
<i>German North Sea Ports :—</i>					
Bremen	1,061	786	943	3	10
Bremerhaven	2	—	—	—	2
Wilhelmshaven	497	569	406	2	8
Veegesack	128	169	66	2	4
Emden	21	11	—	1	5
Hamburg	671	406	408	2	3
	2,380	1,941	1,823	10	32
<i>German Baltic Ports :—</i>					
Flensburg	187	210	70	3	3
Kiel	7	2	—	—	7
Wismar	83	50	40	1	—
Lübeck	24	23	—	—	3
Danzig	44	46	—	—	1
Gdynia (naval units)	9	15	—	1	—
	354	346	110	5	14

TABLE II—continued

Targets in	No. of Sorties Despatched.	Tonnage of Bombs dropped in Primary Target Area.		Number of Operations.	
		H.E.	Incendiaries.	Night.	Day.
<i>The Low Countries :—</i>					
Flushing Docks	6	5	—	—	1
Den Helder Barracks	9	—	—	—	1
Ostend Docks	12	10	—	—	1
	27	15	—	—	3
<i>Targets in Channel Ports :—</i>					
Cherbourg	18	16	—	—	2
Boulogne	12	9	—	—	1
St. Malo	12	11	—	—	1
Le Havre	45	71	—	3	1
	87	107	—	3	5
<i>Coastal Shipping</i>	15	8 (including alternative targets.)	—	—	2
<i>Anti-Submarine and Convoy Patrols</i> ..	343	(Depth charges and bombs dropped.)			61
<i>Minelaying</i>	1,284	2,966 mines laid.		44	—
TOTAL EFFORT	4,490	2,417 (excluding mines).	1,933	62	117

(c) OPERATIONS RELATED TO THE WAR AT SEA

(i) Raids on German North Sea Ports

Bremen.—More than a third of the total weight of bombs on naval objectives was directed against the great and heavily defended port of Bremen, its shipyards and numerous factories, warehouses and transport facilities. These were the target for strong bomber forces, amounting in all to more than 1,000 sorties, on three nights during the quarter. A number of small-scale daylight attacks were also attempted.

Much the most successful of these operations took place on the night of 4th/5th September, when the main force effectively bombed the dock and built-up areas in the light of marker flares and "blob" incendiaries released by the Pathfinder Force. (Nearly fifty 4,000 lb. H.E. bombs were dropped and an 8,000 pounder was seen to burst in the target area.) Widespread smoke, which is clearly seen on the night photographs, combined with the dazzle-effect of many searchlights to make the recognition of precise aiming-points none too easy, but many fires were still burning in dockside factories and warehouses, and in residential property in the city centre, when reconnaissance photographs were obtained next day.

The Atlas Werke Shipyard had two workshops gutted. The Weser Airframe Factory (Fig. 9) was seriously damaged, the machine-shop being almost completely destroyed and other buildings damaged by blast. On the quayside adjoining the Weser Railway Station a number of large warehouses were destroyed by fire.

Railway damage was considerable; sheds on both sides of the line south of the Neubau Station were still burning on the day after the raid and at the Goods Station (already severely hit in the June attacks), 220 yards of covered goods sidings were destroyed. In the old city fire spread far beyond control and much residential and business property was devastated. Six acres of such property near the river were still blazing next day. Among other incidents, military barracks were damaged in two districts of the city. The Focke-Wulf Works, also, was attacked by Lancasters of No. 5 Group, and one of the main buildings there received a direct hit.

The other raids on Bremen were less effective by comparison, but in that of 13th/14th September, the Focke-Wulf Works (which had been damaged severely in the Thousand Raid of 25th/26th June) was again usefully attacked. In one section of the works covering 19 acres, a third of the buildings was devastated by fire and H.E., including the complete destruction of 18 store-sheds, many of which measured some 140 ft. in length. In the Hemelingen district, two factory buildings of the Lloyd Dynamo Works were put completely out of commission, while part of the Carl Borgward Works (producing armoured fighting vehicles and motor transport) was gutted (Fig. 11). This was in addition to damage distributed over several parts of the city affecting public buildings and residential property—probably the most important example of which was the firing of the Deutsche National Bank.

The most useful damage known to have been caused in the July raid was the additional destruction at the important textile works at Delmenhorst which had already lost 200,000 square yards of its factory area as a result of the June Thousand Raid. The July damage added 5,000 square yards of destruction in the main workshops, besides extensive damage to other buildings, of the elaborate "Nordwolle" concern, which the Nazis had turned into one of the finest and most up-to-date wool-combing plants in Europe. The destruction of wool and other materials in course of manufacture, such as lanoline, for protection against frost bite, may well be of particular importance; much of the current through-put of the leading textile mills would certainly be required for the German troops who are now facing their second winter on the Russian fronts.

After the same raid it was seen that the subsidiary Weser Airframe Factory at Lemwerder had been damaged; an assembly shop had been hit and there were two smaller points of damage in the works. It is likely, however, that this was a result of the raid of the previous week when some aircraft claimed to have bombed in this area.

Wilhelmshaven.—Very important damage was inflicted in the course of two night attacks on the naval base of Wilhelmshaven. The raid of 8th/9th July was the first heavy assault on this target for many months and it was reported to have largely recovered from damage inflicted during last winter. A good proportion of the strong force correctly identified the target area in spite of haze, although a number of aircraft were misled by a few sticks of flares and incendiaries which for a variety of reasons happened to be dropped some distance away.

Reports of crews which returned with photographs of the target show that a good weight of bombs fell in the right places, and most substantial fires were left blazing in the important region of Bauhafen. Reconnaissance by P.R.U. revealed that in the Naval Dockyard, west of the Bauhafen, the Armour Plate Shop was completely burnt out, half of the Foundry gutted, four sheds destroyed by fire and others severely damaged (Fig. 12). East of the Bauhafen many warehouses and ships' stores were destroyed.

Two naval barracks and the Marine Superintendent's offices were also hit; and the Deutsche Werke naval shipbuilding yards on the north side of Tirpitz Hafen suffered severe damage to their Engineering Workshops and Smithery. Several serious incidents amongst residential property were seen on daylight photographs, particularly in the north-west district, while other damage had occurred in all parts of the town. Russian sources also declare that the submarine building yards suffered, and that a bomb pierced the concrete protection of an underground depôt used as a store for mines, torpedoes and bombs causing considerable damage; though this latter incident cannot be seen on photographs.

The attack on 14th/15th September was hampered by thick haze over the target, but many aircrews successfully identified and bombed the dock area, and their claims are borne out by the night photographs. This raid appears to have achieved considerable success at very low cost, as only one per cent. of the strong force was missing.

Hamburg.—This was the target assigned to strong bomber forces on two nights in late July when it once more came within range under cover of darkness, and bright moon facilitated target location. On 26th/27th July the operational groups at their maximum strength engaged in the attack on the main target or in subsidiary Intruder effort aimed at fighter aerodromes likely to be used in countering the main force.

Most crews reached the target area and recognised it correctly in the good weather conditions which they found there. Some parts of the city were covered with smoke in the latter part of the raid and a certain amount of cloud drifted across the target from time to time. Probably as a result of this the main weight of the attack fell on residential areas in the city and suburbs, the damage to the all-important docks and factories being smaller than was hoped. However, the city as a whole experienced a severe Blitz, and many parts were seen to be well ablaze by crews who witnessed the closing stages of this brief but heavy attack. The night photographs show that incendiaries started particularly good fires in the St. Georg district, and to the east of the Aussen Alster lake. Moreover, many 4,000 lb. bombs were seen to burst in built-up districts, and their effect on morale must have been considerable.

The most important incident shown by reconnaissance was near the Binnen Alster where an area of 12 acres was severely damaged by fire involving the destruction of more than a dozen blocks of business premises. There were many acres of devastation throughout residential areas of the city and suburbs. A considerable number of blocks of flats and other dwellings were destroyed in the working class districts as well as six military barrack blocks, dockside, warehouses and factories. The re-housing authorities must have been confronted with a serious problem as a result of this raid, and there is little doubt that industrial production will have been affected.

Deterioration in weather conditions largely frustrated the "repeat" attack two nights later which was planned to be made with the whole resources of the Command. More than half of the moderately heavy force which eventually set out for Hamburg or fighter aerodromes *en route* had to be recalled, or were obliged to return to base before reaching enemy territory. Severe icing conditions were met with over the North Sea and only 68 aircraft are known to have reached the target area. The formidable defences were favoured by the low concentration and losses were considerable. However, the force put up a very good show and a number of aircraft successfully penetrated the defences causing fresh incidents of damage in the city. Some crews reported blinding concentrations of searchlights which entirely prevented observation of results, but others managed to evade the beams and saw river, docks and city very clearly.

Veegesack.—On two occasions night attacks were directed against the U-Boat yards at Veegesack on the Weser, north of Bremen. Thick cloud prevented visual identification and crews had to bomb the estimated position of the target without seeing the results. The submarine building yards cover only a small area and, under these conditions, it is too much to expect that any really important damage resulted from these attacks.

NAVAL DAMAGE AT WILHELMSHAVEN

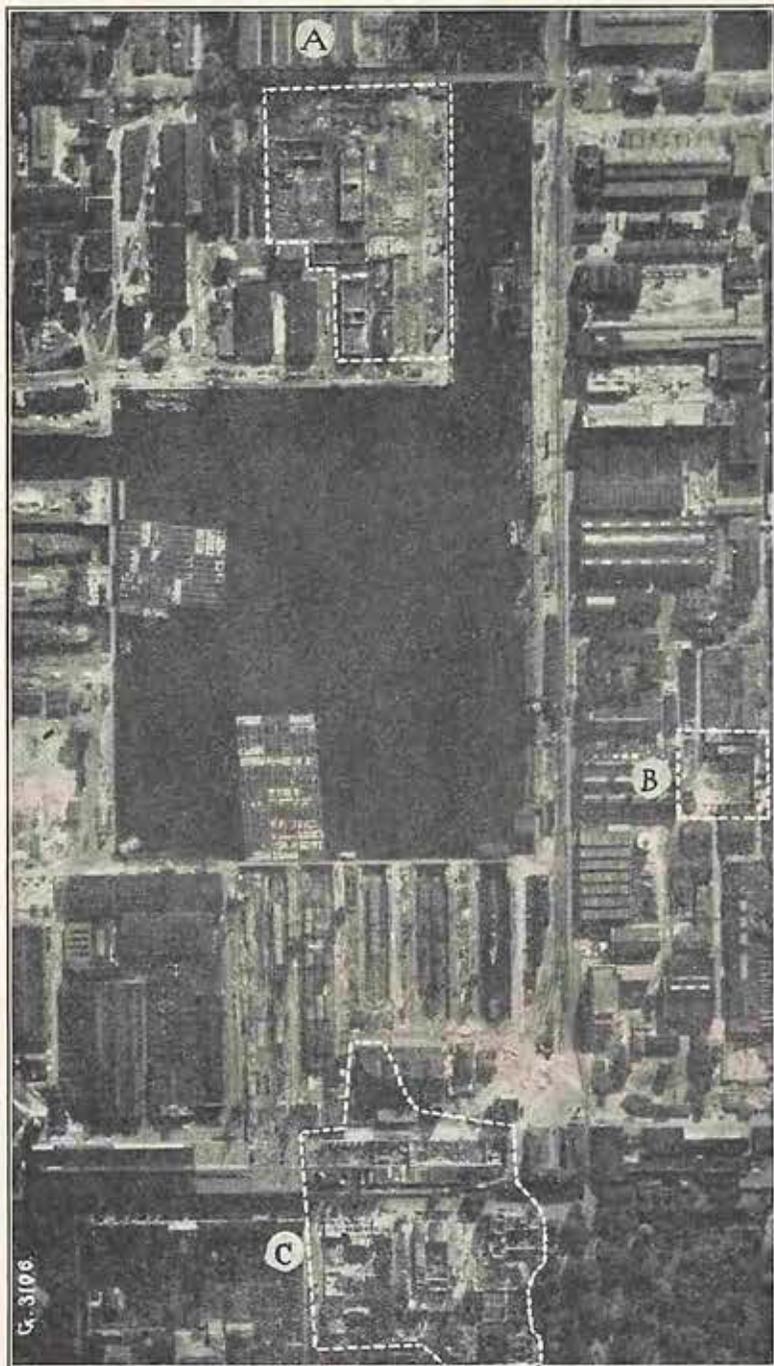


FIG. 12.—Important damage was caused both in the Bauhafen area (seen above) and in the Tirpitzhafen during the attack on 8th/9th July.
(See page 10.)

- A—Ten warehouses and engineering stores completely destroyed by fire.
- B—The naval foundry destroyed.
- C—Extensive damage in the naval dockyard west of the Bauhafen, including the complete destruction of the armour plate shop.

Further damage to the dock area resulted from the raid of 14th/15th September.

DAYLIGHT ATTACKS ON OCCUPIED PORTS

(See page 11.)

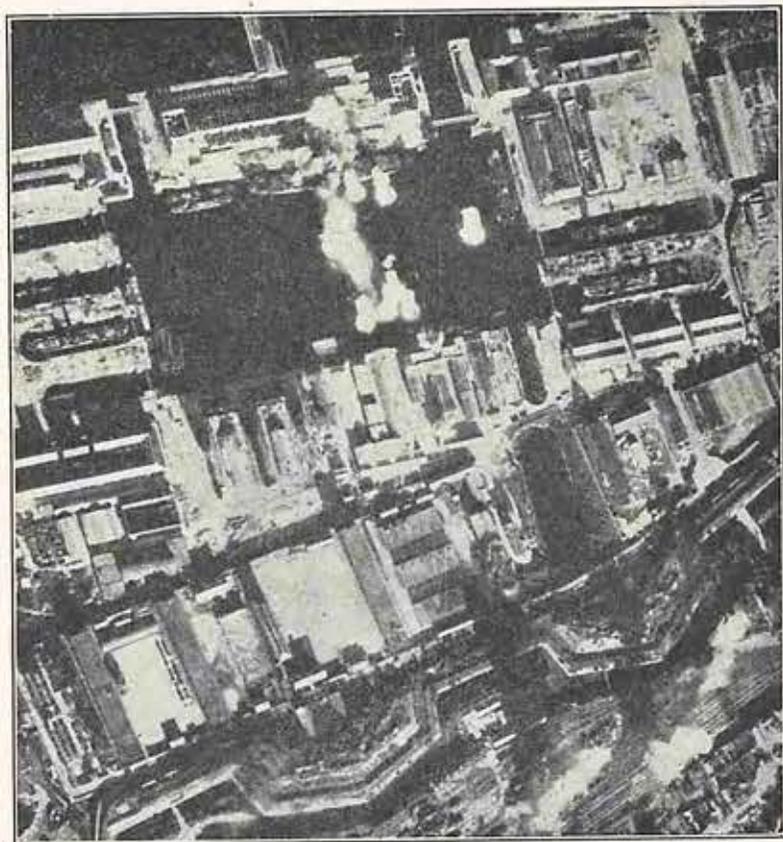


FIG. 13.—The German *Solglimt*, a 12,000-ton whale oil factory ship, was destroyed by Bostons in their attack on 15th September. The vessel is here seen in the Bassin Napoléon III at Cherbourg with bombs bursting directly amidships and on the adjoining quayside. Our aircraft returned without damage. (See page 11.)

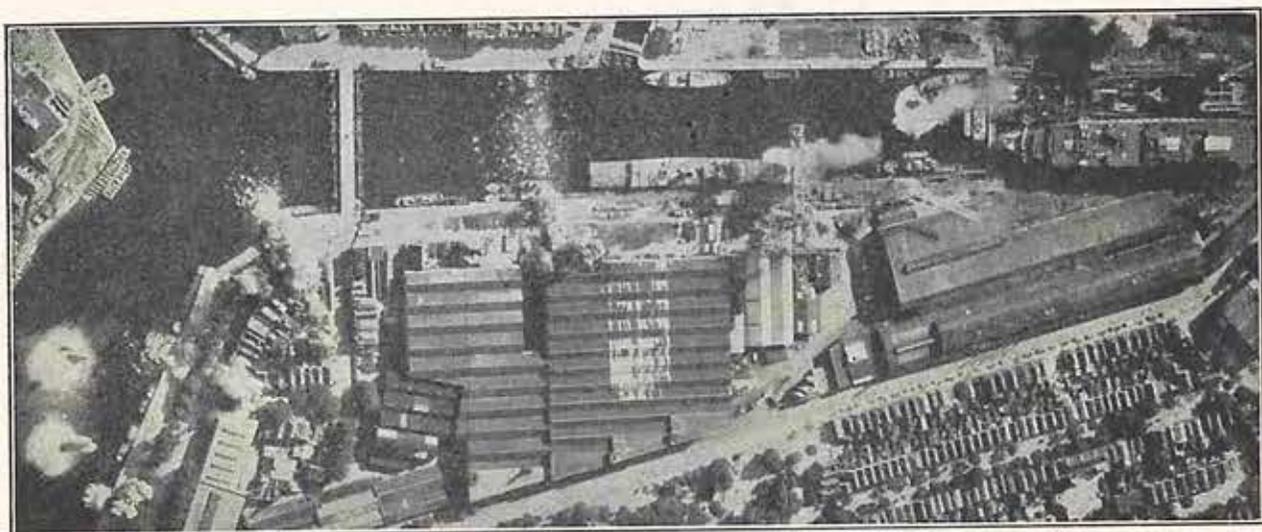


FIG. 14.—The Bostons' attack on Flushing docks (1st August) in progress. During this attack five hits or near misses were scored on the Schelde naval shipbuilding yard. In the above print can be seen a burst on the wall of the main engineering and erecting shop (centre), a burst under the bows of the liner *Princess Juliana* in the Marine Dock, and a direct hit on one of the shipbuilding sheds (top right). Part of the adjoining aircraft works was also hit during this attack, and other bursts occurred subsequently in the area shown above.

(ii) German Baltic Ports

Flensburg.—The busy naval dockyard situated at the Baltic end of the German-Danish frontier was visited three times by night and three times by day. The forces despatched were generally small, with the exception of the first night attack which coincided with the introduction of the "Pathfinder" technique. Extremely poor visibility was experienced, and although the Pathfinders brought the Main Force to the neighbourhood of Flensburg, it was impossible to identify the target in such unfavourable conditions.

On the other hand the daylight raids by heavy bombers inflicted some very important damage. The Lancasters which bombed the target at dusk, on 28th July, severely damaged the submarine building yards. Photographs showed that the frame and angle-bending shop had been wrecked over an area of nearly 40,000 square feet, and as the roof damage extended further it was possible that the adjoining shipbuilding shop was affected. In addition, new holes seen in the roof over the building slipways suggested that hits may have been scored here also. Photographs taken after the Mosquitoes bombed Flensburg in daylight, on 2nd July, showed that the town gasworks was effectively battered during this raid. One of the principal buildings, measuring 180 ft. by 65 ft., was entirely gutted; while another of 120 ft. by 50 ft. was well ablaze. The gasholder, 80 ft. in diameter, was pierced, and large sheds adjoining it were burnt out.

Wismar.—A night attack in bad weather was made by specially-equipped aircraft, on 23rd/24th September, and a number of fires were started in the target area. In the absence of daylight reconnaissance it is not possible to assess results, but crews' reports suggest that this raid was successful. The weather was, as one Pilot put it, "The friend of the Hun all the way"—but the Lancasters came down below 10/10 cloud, in some cases to roof-top height, to bomb the Dornier Aircraft Works and neighbouring objectives.

Lübeck.—The dusk attack by about 20 Stirlings of No. 3 Group on the 16th July, caused the destruction of the main buildings of the Foundry Power Station alongside their target, the U-Boat yards. Buildings adjoining the Benzol recovery plant were also severely damaged.

Danzig.—Here also a determined attack was made against the U-Boat building yards in the course of a daring 1,500-mile daylight operation by more than 40 Lancasters of No. 5 Group. The Lancasters reached their target at dusk rather later than planned, and thus had to bomb in semi-darkness. Several areas of severe H.E. damage were seen on subsequent reconnaissance near the U-Boat yards, though the yards themselves do not appear to have suffered directly. Three buildings of the town gasworks were effectively destroyed, among other industrial damage, and 1,300 Germans were rendered homeless. The death roll included 11 members of the Air Defence Service. This is the most distant target ever attacked by a considerable force of home-based bombers, and in view of the course flown in daylight the loss of two aircraft must be considered very light.

Gdynia.—German naval units in this occupied Polish port were attacked by a small force on the night of 27th/28th August, but bad weather and poor visibility hampered the operation.

Emden, Kiel and Bremerhaven were other targets frequently assigned to small numbers of bombers, mostly operating singly by day in cloudy weather. In many cases, however, results were unobserved and sometimes alternative targets were attacked; but it is likely that these raids effected their main purpose of setting off the warning over wide areas of Germany, thus interfering with work in shipyards and factories.

(iii) Occupied Ports in the West

Le Havre Docks.—Except for "Intruder" patrols this was the only target in occupied territory against which our bombers made night attacks during the whole quarter. Only two night attacks were carried out on Le Havre (by small numbers of freshmen crews), the third attack being abandoned as the docks were obscured by thick haze. The night photographs suggest that the small raid of 9th/10th August was successful.

The only daylight raid on this target (8th September) was definitely successful, as photographs taken by the six Bostons showed hits on two "M" class minesweepers moored alongside each other. One burst occurred on the starboard and port sides respectively of the two vessels, just aft of the superstructure, while another bomb burst between funnel and bridge of the inner of the two minesweepers. A direct hit was scored on a large dockside warehouse, and three more bombs fell on the north and south quays of the petrol basin.

Cherbourg.—Bostons twice raided targets in Cherbourg Docks in daylight. On 15th September, 12 Bostons, escorted by Spitfires and Typhoons, carried out a very accurate attack on the 12,000-ton *Solglimt*, an important German whale-oil factory ship docked in the Bassin Napoleon III. Despite considerable heavy flak many bombs exploded on the quay close to the vessel and at least two scored direct hits on the ship. Our Bostons suffered no damage, while reconnaissance next day showed most of the port side and part of the starboard side of the target had been demolished down to the water-line, it appeared to have been gutted by fire and to have settled down on the bottom of the dock. (Fig. 13.)

The *Solglimt* was originally a Norwegian ship but she was captured in the Antarctic by a German raider and sent to Bordeaux with a prize crew. From there she worked her way up to the Channel, doubtless bound for a German port where she could be converted into a tanker or U-boat supply ship.

Boulogne was twice attacked by Bostons; and *St. Malo* once (31st July) when various port facilities were hit, two bombs burst near merchant vessels in the harbour and a factory was damaged.

Ostend and *Flushing* were attacked once when the Bostons again did some useful bombing. On the 1st August five hits were scored on the Schelde Shipbuilding Yard at Flushing (Fig. 14), including a hit on the timber store. Part of the aircraft factory may also have been damaged and one bomb burst almost under the bows of the liner *Princess Juliana*. The wharves at Ostend were bombed on 29th August, when many bombs burst on the quays and one burst occurred right at the entrance of the strongly roofed E-Boat pens.

(iv) Anti-Shipping and U-Boat Patrols

Attack on "Altmark" Class Tanker.—Lancasters of No. 5 Group were ordered to locate and bomb a German tanker of the *Altmark* class which was attempting to break out of the Bay of Biscay. As this class of vessel is thought to play a key part in supplying the enemy's submarine navy engaged in the Battle of the Atlantic, the result of the attack may be considered very satisfactory: the tanker was damaged by a hit forward, and had to return to port for repairs.

Anti-Submarine Warfare.—In addition to squadrons already serving with Coastal Command, Lancasters of No. 61 Squadron were loaned in July for long-range U-Boat patrol in the Bay of Biscay. On their very first operation (17th July) following up an attack by a Coastal Command aircraft, they succeeded in obtaining a kill. The U-Boat was seen to sink stern first, followed presently by a large oil patch on the surface, and the U-Boat crew took to the water. Whitleys from No. 10 O.T.U. have done very good work against submarines at sea since mid-August, sighting 13 U-Boats, seven of which sightings developed into attacks.

(v) The Minelaying Campaign

Whenever the weather forecasts gave reasonable promise of success, our bombers concentrated on Germany's war industries in the Baltic and North Sea Ports, and the complementary centres in the heart of the continent. But when "bombing weather" was not available the attack took another form—less direct, perhaps, but no less effective to judge from reports and the press of neutral countries.

The great increase in Bomber Command's minelaying activities, which was one of the outstanding features of the April–June period, was fully maintained during last quarter. Indeed more mines were laid than in any other quarter since the start of the war—nearly ten times the number for the corresponding period of last year.

	<i>No. of Sorties.</i>	<i>Mines Laid.</i>
1941 (July–September)	364	315
1942 (July–September)	1,284	2,966

Many of the heavy bombers engaged on these tasks have repeatedly visited the busy waters of the Eastern Baltic, thereby greatly hampering the flow of supplies to the Axis front in North Russia. The Baltic, the Germans' *Mare Nostrum*, is no longer a haven of refuge where naval craft and crews can carry out their training in carefree security. British mines as well as Russian submarines confront them with the perils of total war in their home waters. There is now hardly one area frequented by German shipping, from the occupied ports of Western France on the one hand to Polish and East Prussian waters on the other, where the Germans can feel free from the menace of our mines. Our aircraft have even come in at low level to lay mines in the land-locked approaches to German naval bases. Such sorties are not likely to be uneventful for the crews—but they are certainly not without effect on the enemy, for all the strenuous effort he puts into his mine-sweeping patrols. It cannot be expected that the proportion of ships sunk to mines laid has remained constant—for one thing the enemy is not so obliging as to increase the number of his ships in proportion to our effort. But week after week reports of sinkings continue to come in, and it is known that there are many other incidents which are not reported, particularly where vessels have been damaged but not sunk.

Of those ships reported sunk by mines during this period a few instances may be selected. The appropriately named German transport *Wuri* was mined and sank in the Kattegat off Limfjord. She was a vessel of 7,000 tons and carried at the time 500 mechanics of the German Air Force as well as 1,000 other men and equipment. 400 casualties were landed at the Danish port of Aalborg and it is known that at least a hundred men were lost.

Several large German merchant ships have been sunk or seriously damaged by mines during the present period and, besides these and many smaller German vessels, numerous neutral ships on German service have suffered from our mines. This is not surprising in view of the Nazi policy of obliging neutrals to provide the bulk of the tonnage required to transport to Germany such essential supplies as the special quality iron-ore which they can obtain only from Northern Norway or from Spain. One report mentioned the sinking of a number of vessels engaged in carrying coal on the Rotterdam–Baltic route during June and July. Towards the end of September it was reported that two iron-ore ships were sunk at the entrance to Bayonne and all other ships carrying ore from Bilbao were stopped owing to danger from our mines.

A modified type of magnetic mine which we were laying during last quarter gave particular trouble to the Germans, and also to Swedish ships in enemy waters, as their sweepers failed to deal with mines effectively. The Trelleborg–Sassnitz ferry service was for a period entirely suspended as a result of this situation.

(d) SPECIAL OPERATIONS

The Combined Raid on Dieppe.—Bostons were assigned three tasks on 19th August: the first wave had to assist the landing operations by laying smoke screens over enemy batteries, the harbour of Dieppe and the beaches where our troops landed; they also machine-gunned the enemy's flak positions. This wave encountered strong opposition from light and heavy flak, but after 8 a.m. the ground opposition decreased noticeably. The second and largest force of Bostons attacked coastal batteries on the cliffs, strongly opposed throughout by enemy fighters which made aiming difficult owing to the constant need for taking evasive action. A small force were detailed to search for approaching tanks on the Dieppe-Rouen road, but no tanks were found. These operations entailed great exertions on the part of the Boston crews as well as a high degree of daring, particularly in laying screens at a very low level at the opening phase of the attack: about half the aircraft of this first wave were damaged by flak. That only three Bostons were lost throughout the day's operations was largely due to the continuous and effective cover provided by Spitfires of Fighter Command.

The Gestapo Headquarters, Oslo.—Towards the close of the quarter, on 25th September, four Mosquitoes carried out their brilliant assault on the Gestapo headquarters in the Norwegian capital. It was known that an important Nazi-Quisling rally was to be held during the afternoon of that date and the attack was planned to demonstrate British determination to support loyal Norwegians against their foreign oppressors. The Mosquitoes reached the capital as Quisling was making his speech and (although attacked by enemy fighters) flying just above the roof tops the crews succeeded in spotting the Gestapo building with its Nazi flag. All the bombs fell in the immediate neighbourhood of the building (Fig. 10) and, although property on the opposite side of the road was more seriously damaged, the Nazis had very many windows smashed—even the sashes were torn out by blast—and their building was scarred and shaken. There is no doubt that they themselves were severely shaken too: their rally was seriously interrupted and while they were constrained to carry out the intended parade its effect was further marred by a false warning.

Reports from Sweden state that this daring episode was the main topic of conversation in Stockholm the following day and that it gave great encouragement to all loyal Norwegians. One Swedish source stated that a 500 lb. bomb scored a direct hit on the Gestapo building, but unfortunately ricocheted off before exploding. As it was 19 Germans are said to have been killed.

II.—INTERESTING FLYING INCIDENTS

(a) O.T.U. Crews Deal with Night Fighters

In order to increase the hitting power of the Command, crews from O.T.U.s have been brought in on certain large-scale operations against the Reich. Thus some crews who in the past would first have become acquainted with operational conditions on a leaflet task or on a trip to one of the Channel ports, have recently made their début on such targets as Cologne and Düsseldorf, situated in the thick of the German defences. Not only have these crews made a very substantial contribution to the weight of our recent assaults on Germany, but many of them have also shown exceptional courage and skill in combat with the enemy's keenest weapon—the night fighter. The following examples all taken from the night of the first big raid on Düsseldorf (31st July/1st August, 1942) well illustrate this point.

A Wellington Ic of No. 21 O.T.U. was approaching Düsseldorf at 0145 hours when a Ju.88 was sighted at about 600 yards on the green quarter, slightly below our aircraft. Flying height was 12,000 ft., visibility good, with no cloud, and three-quarters moon ahead. The enemy aircraft approached and fired at 300 yards. The Wellington rear-gunner held fire until he was at 200 yards range, when he gave two short bursts, and a third at about 50 yards, as the enemy broke away to starboard. The Ju.88 burst into flames and went spinning towards the ground. He was seen to crash on the ground by the rear-gunner, pilot and 2nd pilot, and was claimed as definitely destroyed.

Simultaneously another Ju.88 was sighted by the front-gunner at 200 yards on the green bow. The enemy opened fire, to which the Wellington front-gunner replied immediately. The Junkers approached to within 100 yards, both aircraft firing continuously, and then broke away to port and was not seen again.

During these combats the Wellington pilot took mild evasive action; his aircraft suffered only slight damage—a few holes in the main-plane and one in the fuselage near the tail. The crew were uninjured, and they returned safely after adding their bombs to the large conflagrations already raging in the industrial area of Düsseldorf.

Another Ju.88 was destroyed on the same night by a Wellington Ic of No. 12 O.T.U. when attacked near Antwerp on the return from Düsseldorf. The enemy made one attack from astern, opening up from 600 yards firing tracer from the nose until within 300 yards. The rear-gunner of the Wellington opened fire at 500 yards and continued firing till the fighter came within 200 yards, scoring hits on his starboard engine. The enemy aircraft rolled away, diving towards the ground with smoke pouring from it, and a fire was seen on the ground shortly afterwards. The combat, which took place at 7,000 ft. in good visibility, lasted about two minutes, and the rest of the journey was uneventful.

On the same night two Halifaxes of No. 1652 Conversion Unit accounted for two more Ju.88s. All the gunners concerned were straight from O.T.U.s, and it was their first trip. Both incidents occurred at the Dutch coast near Overflakke on the homeward journey and within ten minutes of each other.

At 0234 hours Halifax "N" saw an aircraft showing all navigation lights on the starboard quarter and slightly above. It soon turned out to be a Ju.88 as it rapidly closed in to 150 yards, at which range our rear-gunner opened fire with a long burst. The enemy then broke away below the starboard quarter, the Halifax taking evasive action by "corkscrewing" during the attack. The enemy reappeared astern, and as he closed in to 100 yards the Halifax mid-upper and rear-gunners opened fire at that range. All the lights on the Ju.88 went out, and it dived vertically into the sea. A few minutes later the Halifax was attacked from dead astern by an Me.109, but after an exchange of fire the enemy broke away and was not seen again.

Meanwhile Halifax "M" was attacked (at 0243 hours) by a Ju.88 which appeared from port quarter above and rapidly came in dead astern. At 200 yards both the enemy aircraft and our rear-gunner opened up. The Halifax was not hit and our gunner next gave the Hun a 10-second burst. The enemy at once caught fire, turned over on its back and went down in flames. The whole action lasted only about 40 seconds.

(b) A Hampden Pilot's Opportunity

Hampden "K" of 408 (R.C.A.F.) Squadron, flying at 5,500 ft., was well on its way to bomb Kassel on 27th/28th August when the top gunner reported an aircraft slightly above on the green quarter at 2,000 yards range. It was soon identified as a Ju.88.

Acting on the instruction of the top gunner, the pilot dipped his starboard wing, applied the opposite rudder, and went sliding along on his side. The Ju.88, evidently under the impression that the Hampden was turning in to him, put his nose down and dived, passing underneath our aircraft. This enabled the Hampden gunners to fire very long bursts at him, while the enemy's rear-gunner was also firing.

Just as they had changed their magazines the Ju.88 came swinging in, firing with his front guns. Again the Hampden gunners were on the mark and fired very long bursts, the tracer entering the enemy aircraft. The Hampden pilot then put his nose down, at the same time turning to port; as he did so the Ju.88 ceased fire, climbed very steeply, turning sharply to port. This manoeuvre brought him very close in front of the Hampden pilot, who pressed his button and saw the tracer entering the enemy's starboard wing. "It was a sitting shot, and his starboard engine burst into flames."

The Ju.88 turned over on its back and went down into a steep dive. The Hampden followed it down to about 300 ft., when it was seen to strike the ground and blow up.

The pilot believed that his gunners had finished off the enemy crew and that he had administered the *coup-de-grace* with the Browning in the nose of his aircraft. He spoke enthusiastically of the accuracy of his gunners' shooting and the directions they gave him during the combat. Even the navigator had his gun out and had one swift burst at the enemy fighter.

The Hampden got off lightly: the Ju.88 scored a "bull" on the port roundel with a cannon shell, two machine-gun bullets through the port tanks, a bullet through the fuselage aft of the radio installation (rendering the transmitter unserviceable), and a bullet through the port rudder.

After this incident the crew resumed course and bombed their target at Kassel. As they were leaving the target area an Me.109 came up on their reciprocal and swung out to come in on the port quarter. Once more the top-gunner was on the mark and fired a long burst, which caused the Messerschmitt to make off in a hurry, and he was seen no more.

(c) Flying Skeletons (see figures opposite page 16)

A remarkable photograph appeared recently in the Press, of a Wellington IV which returned home from Bremen (4th/5th September, 1942) with the fabric stripped off the fuselage the whole way from the trailing edge of the main-plane to the rear turret. Not the least remarkable feature of this incident is that the Polish crew, who belonged to No. 300 Squadron, flew their aircraft in this skeleton-like state a distance of some 400 miles and made a perfect landing at their base. The crew were uninjured and there was only slight structural damage to the Wellington.

It happened over Bremen at 16,500 ft., amid heavy flak. The wireless operator, who was near the flare-chute, was suddenly blinded by a tremendous flash, and when he recovered his vision he found all the fabric gone. Apparently the trouble had started when a spent A.A. tracer entered the aircraft, damaging one of the geodetics and the wooden bulkhead of the rear D-frame and started the fabric smouldering. As the burned area of the fabric grew larger the slipstream must have torn at it until the whole covering ripped off.

There was a nasty moment over Holland when an enemy fighter was encountered, but engagement was avoided by evasive action—or perhaps "Jerry" just couldn't believe his eyes!

A similar experience befell a Wellington III ("Y" of 150 Squadron) returning from Cologne last April. The photographs, Figs. 15 and 16, give a vivid impression of what it is like to limp home from enemy territory in this stark condition.

"Y"/150 was nearer home when it happened, but the damage was more serious. Just after crossing the Dutch coast on the return to base an Me.110 approached and delivered an attack from the starboard quarter. It opened up at 350 yards with three streams of tracer bullets, starting a fire in the Wellington. Our rear-gunner replied with a short burst, setting the enemy's port engine alight. What happened to the Me.110 is not known as the Wellington crew were busy putting out the fire in their own aircraft.

They succeeded in this, but not before the fabric had been burned and ripped off from main-plane to tail. Nor was that all. Explosive incendiary bullets which struck the aircraft near the after end of the bomb beam had put out of action the hydraulic gear which operates the undercarriage and the bomb doors and shattered numerous geodetics of the fuselage, and both main and tail-plane were damaged. After the attack the aircraft flew with port wing low, bomb doors open and without rudder control. Nevertheless the pilot brought his aircraft back to his base in Yorkshire and, being unable to lock down his undercarriage, made a good belly-landing. Not one of the crew was injured.

(d) Wellington takes a Direct Hit

On 28th/29th July, 1942, "V" of 9 Squadron, a Wellington III, was coned by searchlights over Hamburg and engaged by heavy flak at 14,000 ft. In the course of evasive action the aircraft lost height, coming down to 4,000 ft. before shaking off the searchlights. At some point in the descent a heavy A.A. shell passed clean through the rear fuselage of the Wellington but did not explode, and none of the crew was injured. The remainder of the flight home was uneventful and a good landing made at base despite a burst tail wheel.

Flak damage is usually caused by fragments from a shell bursting often a hundred or more feet from the aircraft affected by it. Although other cases are known of aircraft receiving a direct hit from heavy flak they are extremely rare, so that the nature of the damage in this case is of considerable interest.

The shell which struck "V"/9 entered the fuselage on the port side below the trailing edge of the tail plane, within a yard of the Rear Gunner. It distorted the longeron, bending it upwards over about a foot of its length. The corresponding geodetics attached to the longeron were also distorted, but the hole where the shell entered the fuselage itself was clean-cut, without jagged edges.

On the starboard side there was a large horizontal gash, also below the tail plane, where the shell made its exit. The longeron had apparently received a direct hit as, in addition to distortion over 4 ft. of its length, 1 ft. of it had been torn out completely and was missing. All the geodetics near the longeron were badly distorted. The leading-edge of the tail plane was slightly damaged; but all damage was due to distortion, no fragment holes being observed anywhere on the aircraft.

The shell-hit had no appreciable effect on the performance of the aircraft. In fact, it was not until they reached base that the crew realised the nature of the damage and its cause.

III.—MISCELLANEOUS ITEMS OF OPERATIONAL INTEREST

(a) Encounters with Balloon Cables

In view of the large number of operational sorties made by Bomber Command aircraft in the quarter July–September, 1942, it is remarkable that only one—a Lancaster—reported collision with balloon cables over enemy territory. Seven German planes hit cables over this country, although the total of their sorties during the period was small compared to our effort.

It might be thought that allowance should perhaps be made for hypothetical cases in which our aircraft may have crashed after collision with enemy cables, but it is known that such cases are extremely rare; indeed, there is no evidence from any source of a single fatal collision over enemy territory during the last six months.

This satisfactory state of affairs is not due merely to the altitudes at which our aircraft fly over German targets, since there have been many occasions on which at least part of our bomber force has attacked special objectives from relatively low levels. A case in point was the attack on the aircraft works at Warnemünde last May, when a Wellington of 101 Squadron severed a cable with its port propeller at a height of only 100 ft., and made the homeward journey of some 600 miles without undue difficulty.

The more recent Lancaster incident already mentioned was unusual from several points of view and is therefore described here in some detail.

On the night of 27th/28th August, "R" of 50 Squadron approached its target at Kassel in brilliant moonlight, flying at 5,000 ft. While making the run-up the pilot had to trim on the rudders to maintain straight flight just prior to releasing bombs. No undue drag or heaviness was experienced and after bombing the aircraft left the target area, coming down to 200 ft. for the homeward flight.

It was then reported by the tail gunner that "two wires" were attached to the port wing and were streaming rearwards to such a distance that their ends could not be seen. These wires were carried for many miles and were eventually lost just before crossing the Dutch coast—possibly as a result of occasional contact with ground obstructions. The Lancaster completed its homeward journey without further incident.

On landing it was found that the leading edge of the port wing had been cut back to the front spar, at a distance of about 8 ft. from the wing tip, evidently by a finely stranded $\frac{1}{8}$ in. cable, as used in the German balloon barrage.

Owing to the peculiar angle at which the cable had struck the leading edge, it had failed to slide over to the nearest cutter box, only 6 in. away from the point of impact. Before that could occur the cable must have tensioned and began to "saw" over the nose of the leading edge. The lower end quickly broke away from its ground anchorage and the relaxation-wave set up in the cable must have caused the release of the balloon, leaving the cable trailing on the wing as observed by the rear gunner. (Since the trim of the aircraft was not altered appreciably, it may be assumed that no double-parachute device was in use.) The cutting of the armoured leading edge was evidently caused by the abnormal sawing motion of the cable, since the plates are capable of withstanding any normal impact at high speed.

It is worth noting that of the seven Bomber Command aircraft which accidentally collided with balloon cables over this country during the past quarter (whether on operational or training flights), those five which were equipped with cutters and protected leading edges were able to continue on course and make safe landings. In this connection, it should be remembered that our cables are thicker and stronger than those used by the enemy. In one case, a Wellington Ic, the impact occurred just outboard of the wing-tip cutter and the cable sheared off the tip of the starboard wing. Despite a temporary loss of control, owing to a tendency to roll and yaw, the pilot landed his aircraft safely.

A remarkable instance of the efficacy of our cable-cutters occurred in 1941. During a daylight attack on Rotterdam docks a Blenheim flying at a very low level impacted a crane cable, the cutters operated and the aircraft continued on course without difficulty. The crane cable was $\frac{3}{8}$ in. diameter with a tensile strength of about 13 tons. As this is several times heavier than any balloon cable used by ourselves or the enemy, it gives a pretty good safety factor for our cutters.

Experience in this country (especially in the "Baedeker Raids") has shown that a balloon barrage is a valuable form of defence, as it invariably causes the Luftwaffe to abandon low-level attacks on vulnerable targets thus protected; in such circumstances German bombers seldom achieve any formidable concentration of damage.

While our aircrews have much to contend with in the way of defences over Germany, they may derive some solid comfort from the reflection that they will seldom encounter balloon cables and, if they do, our aircraft are fully able to cope with them.

(b) Smoke as a Defence against Bomber Command

The first report that the Germans were employing smoke-screens came from bomber crews flying over Berlin on a night in late September, 1940, when an ineffective screen was seen in the Tempelhof district. It seems there was some form of smoke-screen in operation in Berlin throughout the winter of 1940, as a screen was reported in various districts on four subsequent occasions, but it always appeared to be only local in nature and did not cause much trouble. About the middle of 1941 smoke-screens began to be reported from other parts of Germany. They were usually, however, very half-hearted attempts, and it was not until the possibilities of this form of defence had been demonstrated with such success at Brest that the Germans began to take seriously to protection of targets by smoke.

A FLYING SKELETON

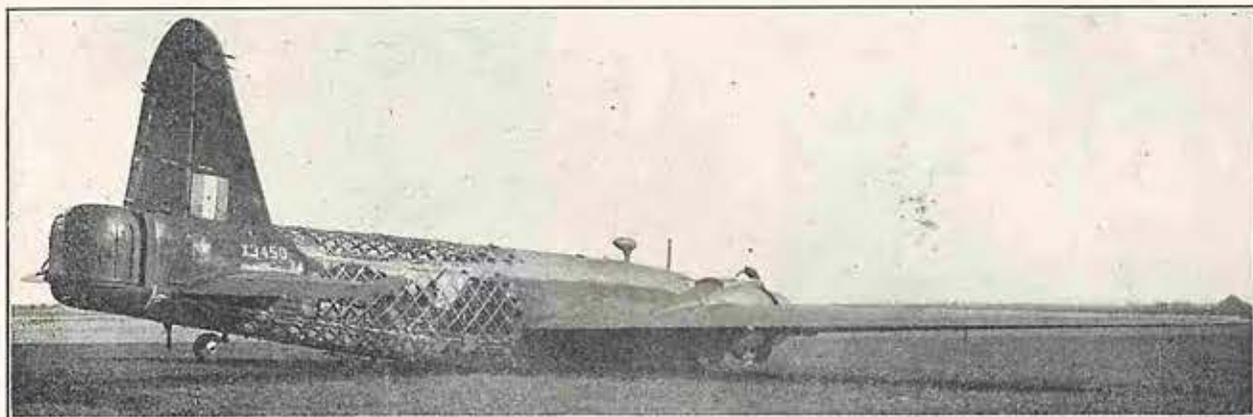


FIG. 15.—A Wellington III of 150 Squadron came home in this condition after attack by an Me.110. The enemy's tracer bullets started a fire which caused the fabric of the fuselage to be torn off from trailing edge of the mainplane to the tail, as well as other damage. The pilot made a perfect belly-landing at base and none of the crew were injured. A similar experience befell a Polish crew of 300 Squadron over Bremen in September. (See page 15.)

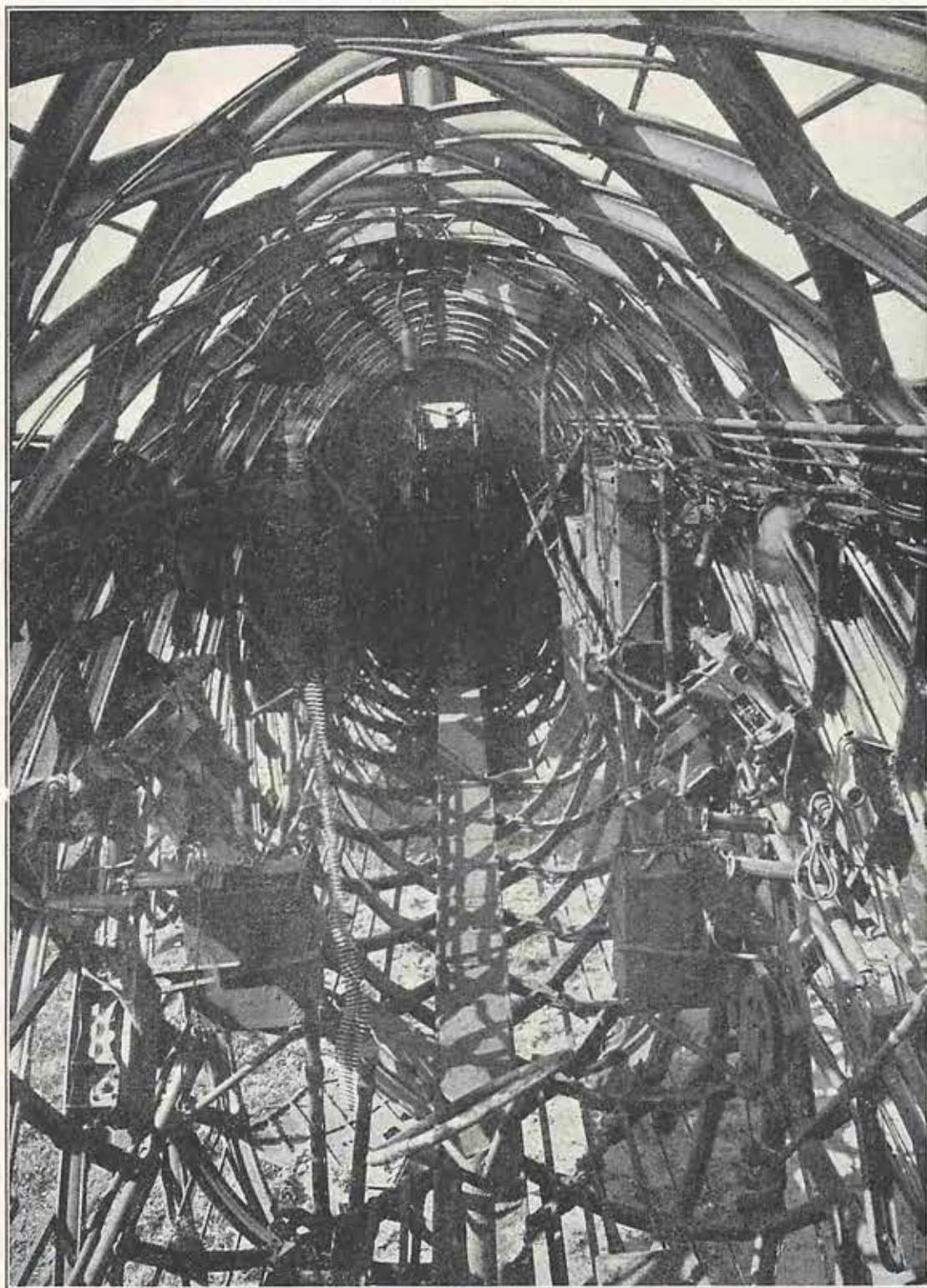


FIG. 16.—The interior of "Y" of 150 Squadron as it returned from Cologne, 27th/28th April, 1942. (See figure 15 above, and page 15.)

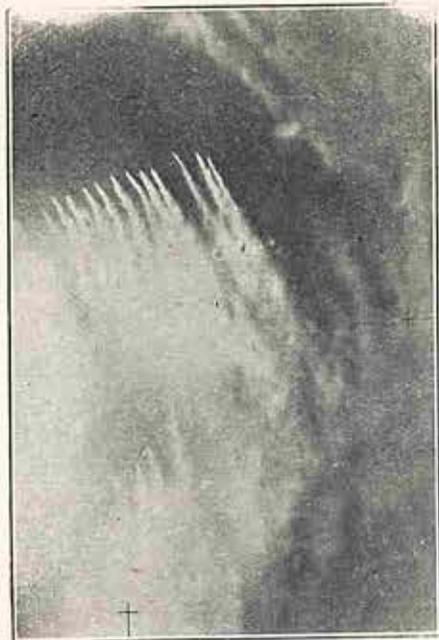


FIG. 17.—The Brest smoke-screen in full operation during a night attack on *Scharnhorst* and *Gneisenau*. Two rows of generators can be seen and smoke from others (off the picture) round the outskirts of the town: an example of a screen operated to cover the greatest possible area

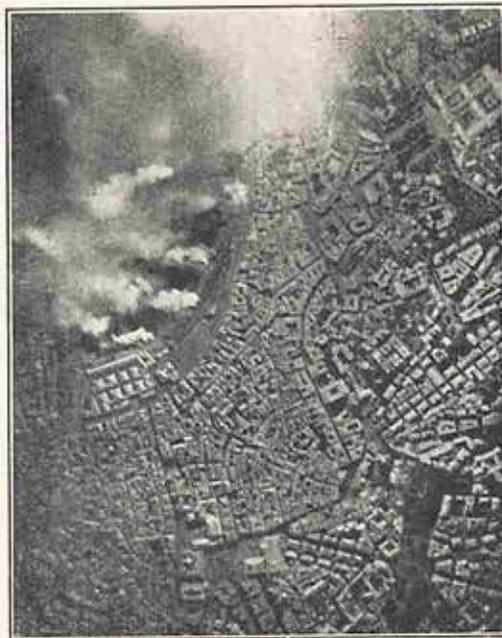


FIG. 18.—The Genoa smoke-screen in operation a year before our recent attacks: an excellent night photograph by "X" of 149 Squadron on 28th/29th September, 1941.

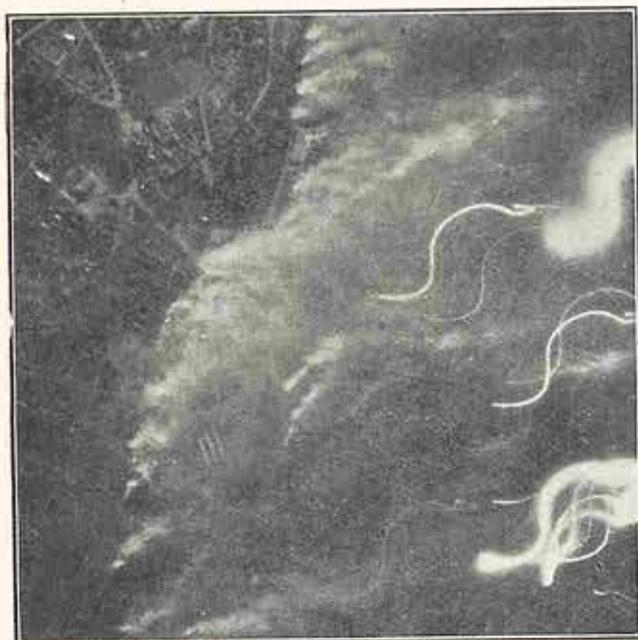


FIG. 19.—The smoke-screen over Kiel, 13h/14h October, 1942. Note that the covered U-Boat slips in the Germania shipyards are not concealed and fires are burning in the target area on the east side of the inlet.

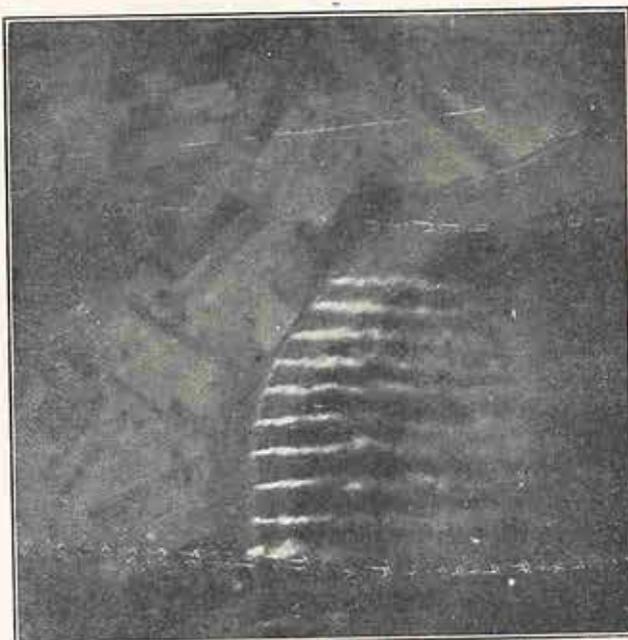


FIG. 20.—A smoke-screen blowing out over the estuary north of the aircraft factory at Wismar, 12th/13th October, 1942. The screen, which is starting up, is intended to conceal the shape of the estuary, thus depriving crews of a valuable landmark.



FIG. 21.—Attack on *Tirpitz* near Trondheim, 27th/28th April, 1942: a night photograph showing the inlet partly covered by a smoke-screen (see Fig. 22). The incident is referred to on page 18.

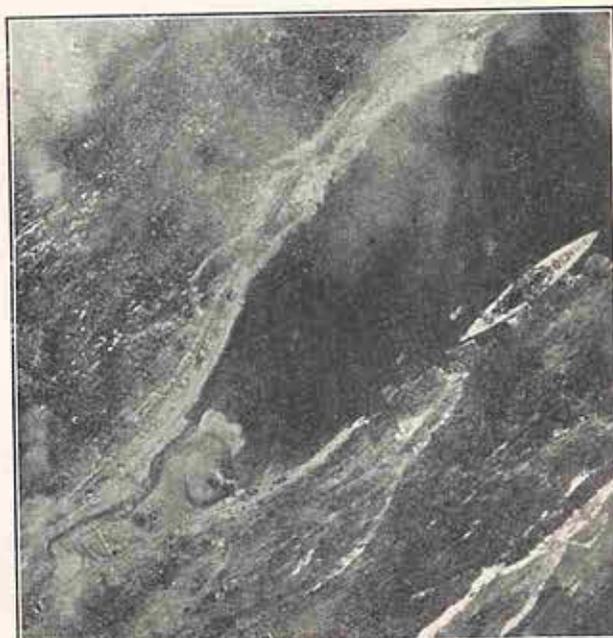


FIG. 22.—*Tirpitz* lying in Foetten Fjord: a daylight photograph for comparison with that taken during the attack (Fig. 21).

The Brest smoke-screen was in operation for approximately nine months, and throughout this time a variety of experiments were made in methods of operating it, with a gradual improvement in its efficiency. Lessons then learnt are now being applied by the Germans with thoroughness at ports along the Baltic coast, where effective screens have recently been observed and photographed at Kiel, Warnemünde, Rostock and Wismar, while another is suspected at Lübeck. In addition to these places similar screens have been photographed at Emden, Trondheim and Genoa and at several North African ports. They have also been seen, though not recently, at Dortmund, the Dortmund-Ems Aqueduct, Düsseldorf, Essen, Gelsenkirchen, Hannover and Magdeburg, and suspected at eight other places. Photographs have never been obtained of a smoke-screen actually in operation in inland Germany, and the most effective screens have all covered naval installations or important factories on the coast (see Figs. 17-21).

That the Germans use this form of defence primarily in coastal areas is due to the fact that identification of vital targets in these areas (often situated in an estuary) is simplified by observation of the shape of the coastline. A smoke-screen not only obscures the actual aiming-point, but may even hamper recognition of the target area by altering the appearance of the coast. (Fig. 20, Wismar.)

It is obvious that the essence of a good smoke-screen is to hide not only the target, but also any surrounding landmarks from which the position of the target might be estimated. Nevertheless, the Germans did not realise this at first. To begin with, the smoke generators at Brest were placed fairly close to the battle-cruisers, and only those on the windward side were turned on; in consequence, once the town of Brest had been located or the Penfold river seen, it was possible to estimate fairly accurately the position of the ships. Later, the generators were extended round the whole town of Brest; while the leeward generators as well as those to windward were in use simultaneously, so that a very large area was thickly covered by smoke and it became a matter of great difficulty to locate the position of the docks within the smoke (see Fig. 17).

Towards the end of the stay of the battle-cruisers at Brest various ruses were employed, such as the use of a decoy screen situated some distance away from the town at a point where the coastline was roughly similar in shape. On one occasion, when the wind was blowing off-shore, the leeward generators only were used, presumably to tempt the crews to bomb through the smoke into the waters of the Rade de Brest.

Encouraged by their experience at Brest, the Germans determined to increase the employment of smoke as a defence against our night attacks elsewhere. The following is a summary of the lessons then learnt and the principles on which they will probably operate future screens:—

- (i) On most occasions smoke effectively prevented accurate aiming.
- (ii) Its presence tended to prolong the time of the aircraft over the target area while searching for the aiming point, and thus exposed the attacking force to greater danger.
- (iii) At first the screen was not always employed on nights with good visibility, probably for fear of hampering ground defences; but later it was always employed, and it was evidently found better to rely on the protection afforded by the smoke and to accept some interference with searchlights and gun defences.
- (iv) It was essential to use many or all the generators, not only those on the windward side, in order to hide landmarks and to deceive our crews as to the location of the target within the smoke.
- (v) The presence of smoke occasionally assisted crews to find Brest; to overcome this a dummy screen was employed. So far no other dummy screen has been recognised as such, but this stratagem is likely to be repeated elsewhere. Three possible ways in which it may be employed are—
 - (a) as a dummy situated in open country short of the target on the route of approaching aircraft;
 - (b) as a screen over the target, and another in the vicinity with the dual purpose of acting as a decoy and covering a landmark known to be easily picked out and used as a fix for locating the area to be attacked;
 - (c) the use of leeward generators only on nights of poor visibility, to tempt aircraft to bomb through the smoke away from the target.

Smoke has also been used a number of times in daylight to prevent photographic reconnaissance, but without much success. Indeed its presence in daylight should always be treated with great suspicion, as it indicates the enemy is trying to hide something unusual. For instance, in spite of all our daylight reconnaissances of Brest, smoke was only used on two occasions, very ineffectually after the first big daylight attack when *Gneisenau* was damaged and, secondly, on the 12th February, 1942, after the warships had left, when it was clearly laid to hide their absence.

There are two primary methods of smoke production; by combustion of smoke-producing materials such as oil or pitch; or by various chemicals. Chemical smokes are the best, and are employed by the Germans who have no lack of suitable substances. One chemical used is probably a mixture of which sulphur trioxide is the main constituent. To produce smoke this mixture has to be dispersed in very fine droplets which take up water from the atmosphere. This was done at Brest by using containers with a spout and nozzle rather like large watering cans, a valve enabling the smoke to be turned on and off at will. The containers are readily portable, but, once the form of the screen has been finally established, are not usually moved. (They are refilled from drums kept alongside and collected at regular intervals for refilling at a central dépôt). This is the normal form of smoke-producing apparatus in use in Germany at present. It is very flexible and can be employed for the many and varied purposes for which static smoke screens are required; it can also be turned on with great rapidity, becoming effective in a matter of minutes.

Two other forms are known to have been used in special circumstances. One is a fixed installation for protecting an individual target situated in a town, where industrial smoke is also present. Such a screen is believed to exist round Krupp's Works at Essen where there is reputed to be a central generating station, the smoke passing through pipes to points of emission round the works.

The other form is used for hiding important vessels lying off-shore, and was employed twice last April to conceal *Tirpitz* from our bombers when they attacked her in Foetten Fjord, near Trondheim. According to a rather doubtful story this particular screen was produced by pouring liquid on the sea from 40/50 gallon drums. Some of these drums were placed at 50-metre intervals along the main road round the edge of the Fjord, while the other drums were ready in the holds of about 20 small vessels. It is said that the Germans were extremely unwilling to start up the evil-smelling smoke screen, and only did so when they considered that a serious attack was imminent. As soon as the liquid was poured on the water a heavy greyish smoke developed, tending to cling to sea level, so that it only gradually spread upward as the concentration increased. It was estimated that about half an hour elapsed before the Fjord was entirely covered, and the screen attained a maximum height of 200 ft.

It is of interest to compare this story of how the screen was produced with the visual evidence of the aircrews who took part in the raid of 27th/28th April. Zero hour was at midnight and the first aircraft bombed *Tirpitz* at six minutes past, in brilliant moonlight and perfect visibility. At 0011 hours another crew found *Tirpitz* "slightly obscured by smoke, but the dark shape of the ship was plainly seen with flak coming from it"; while a minute later another crew noticed that "a smoke screen was just starting at the mouth of the Fjord." *Tirpitz* was still visible from 8,000 ft. when a Lancaster of 97 Squadron took the photograph reproduced as Fig. 21, which shows the state of the smoke screen at 0018 hours. Although whitish smoke can be seen issuing from a series of points all round the shore of the inlet, to windward of the target, the two banks of smoke had not yet converged over the dark water of the fjord; and the crew reported that they saw the stern of *Tirpitz* illuminated by the burst of their 4,000 lb. bomb. The mouth of the fjord is not seen clearly on any of the photographs taken during the raid, but it is possible the screen observed there was produced by a disposition of small vessels as indicated by other sources. (In view of the direction of the wind it is difficult to see how else an effective screen could have been produced to leeward of the battleship.) Half an hour after midnight the target was "completely obscured" while, at 0050 hours, a Halifax made a run up the fjord at 100 ft. until the smoke became so thick that nothing else could be seen and the aircraft climbed above it to bomb the estimated position of the ship with the help of nearby landmarks.

This attack on *Tirpitz* is a good illustration of the way in which Bomber Command crews successfully press home their attacks in spite of the most effective precautions of the enemy. More than half of the thirty-one crews which bombed in the target area actually saw the battleship itself and many bombs were seen to burst close to the vessel. These crews definitely out-maneuvred the German smoke-screen, while the later arrivals made an equally determined attempt.

* * *

To sum up, it would seem that the Germans were at first somewhat sceptical of the value of smoke as a defence against night bombers. They decided to try it out at Brest where it proved a success, and they are now busy extending its use. Indeed, smoke may now be expected over any important target near a readily recognisable landmark, and not only over the target, but over the landmark as well, particularly if it is near the coast. The presence of a smoke-screen is not always an indication that a target lies directly beneath it, and the practice of screening landmarks may become more of a nuisance to our crews than the screening of the target itself.

Experienced bomb aimers find that it is sometimes possible to see through the smoke from directly above, especially in the early stages of an attack. But if the aiming point is completely screened, the only course is to stay outside the target area and observe it carefully from several directions until positions on the edge of the smoke-covered area are accurately pinpointed. From these the exact location of the target can be estimated—and the very existence of the smoke screen shows that whatever it protects is well worth taking pains to hit.

IV.—THREE YEARS' AIR OFFENSIVE AGAINST GERMANY

With the close of the period reviewed in this issue Bomber Command's offensive against Germany is three years old.

These years have witnessed many and great changes. Apart from the continuous endeavour to increase the volume and effectiveness of our operations, experience and the vicissitudes of the war have demanded far-reaching changes in bombing tactics. The initial period was largely characterised by reconnaissance patrols and leaflet flights over the Reich (many made from French bases) and daylight raids by Wellingtons and Whitleys on warships at sea and at anchor. The Germans had not yet bombed this country, and no targets in Germany were therefore allowed to be attacked.

The Battle of France and the German air attacks on this country marked the close of an era and the initiation (albeit on a very small scale) of the policy of bombing German production and transport centres. The development of the three years' offensive since the start of the war is illustrated by the figures in the following table :—

	Tonnage of Bombs directed against Enemy Targets in							No. of Mines Laid.
	Germany.	Italy.	France.	Low Countries.	Norway and Denmark.	Shipping and U-Boat Patrols.	Support of Military Forces.	
First Year ..	3,955	77	279	413	111	65	1,866	579
Second Year ..	20,069	77	5,529	2,321	30	364	38	904
Third Year ..	33,242	120	6,428	1,193	250	160	51	5,692

A full estimate of the results of the increasing effort represented by the above table cannot be given in this note, but an indication of what our "absolutely ineffective nuisance raids" (as Goebbels calls them) have already done to 13 German industrial cities and naval ports is summarised below. The facts here set forth are not based on the verbal testimony of "a Turkish traveller," nor even on the reports of our own crews: the estimate of damage is based on what is unquestionably shown on photographs taken by reconnaissance aircraft.

In order to give some basis for comparison with the Luftwaffe's effort against Britain in 1940 and 1941, it may be stated that the City of London (which is about 650 acres in extent) includes less than 120 acres of devastation after some 70 heavy raids, and well over 100 considerable attacks. In Bomber Command's great raid by a thousand aircraft on Cologne more than 600 acres were devastated, about 50 per cent. of which lie within the 2½ square miles of the Inner City. After exhaustive study of reconnaissance photographs, the Ministry of Home Security has estimated the value of the damage inflicted during this one raid at approximately £60,000,000.

Bomb Damage in German Ports and Industrial Centres

Lübeck.—The island town is a closely built-up commercial and residential area, and 40 per cent. of this, amounting to over 200 acres, has been destroyed or damaged beyond repair with a further area of approximately 100 acres in the built-up area outside the island town. Many factories have been destroyed and others severely damaged.

Rostock.—The havoc in this city is probably greater in proportion to the total area than in any other in Germany. Over 70 per cent. of the old town is completely devastated, amounting to 130 acres. At least another 50 acres outside the old town are destroyed, and this does not include the very severe damage to the Heinkel Works outside the town.

Cologne.—No city in the world has a greater acreage of destruction from bombing than Cologne. Over 600 acres of built-up property have been devastated. This is well spread over the whole city. Vast areas in the Inner City as well as in the highly industrial districts of Ehrenfeld and Nippes have been gutted block by block. Public and administrative buildings, commercial and industrial properties, and a great number of houses in addition have been destroyed. A large proportion of the damage was caused by fire; photographs taken eight days after the great attack of 30th May show only a dead and shattered city. Over 250 factory buildings and workshops were destroyed or seriously damaged.

Düsseldorf.—More than 380 acres of densely built-up area in this city have been destroyed. In the southern part more than half the city is destroyed, mostly by fire. The industrial damage is considerable especially in the Oberbilk and Unterbilk districts—in fact the number of industrial properties destroyed is almost as great as in Cologne. In photographic cover obtained on 1st August following a raid the previous night over 20 fires can be seen still burning in the city.

Mainz.—135 acres of the built-up area of this town have been devastated. The main weight of the two attacks, on 11th/12th and 12th/13th August, 1942, fell on the town centre, which has been obliterated. In fact, the concentrated nature of the devastation in the centre of this town has no equal in comparison with other German towns. Heavy damage has been caused to factories, especially in the Biebrich district, and eight military barracks and depôts have been severely damaged.

Karlsruhe.—The raid of 2nd/3rd September, 1942, on this town caused tremendous damage. In all, 360 acres of built-up area in town and docks were destroyed. Many large areas of civic, commercial and industrial property were completely gutted by fire, including over 700 houses. The industrial damage is severe especially at Grünwinkel and at the east end of the Rhine Harbour, where one large fuel storage depôt measuring 1,350 ft. in length was burning fiercely nine days after the attack.

Saarbrücken.—Severe damage, affecting over 70 acres, was inflicted on this town principally during the heavy raid on 29th/30th July, 1942. The two main factories—the Eich Dudelinger Iron Works and the Ehrhardt and Schmer Engineering Works—suffered considerably. The shopping and business centre also suffered, and in the Malstatt district alone 140 houses in one housing estate were destroyed.

Emden.—This port has been raided repeatedly since 1940, and fully 60 per cent. of the town and dock areas has been destroyed. The Nordsee Werke Submarine-building Yard has been practically eliminated and over 10 acres of its buildings destroyed. Most sheds and workshops on the quaysides of the shipping repair yards have also been destroyed.

Osnabrück.—Over 50 acres of built-up areas have been devastated. Twenty-five acres of this damage lie around the Kanal Hafen, where nearly 40 warehouses are destroyed. The Harbour Bureau and Board of Trade Offices are gutted by fire and there is considerable damage in the business and residential centres. Nine acres in the town centre round Grosse Str. have been gutted by fire.

Bremen.—Many raids in this city have taken their toll and the damage, although not quite on the scale of Cologne, is steadily accumulating. Nearly a fifth of the old town is devastated and several areas in the Sudervorstadt district, including one of 35 acres, have been gutted by fire. Buildings in the docks have been damaged or destroyed and much industrial damage has been done in the Hastedt and Neuenland districts, including destruction of buildings in the Focke Wulfe Works. The Hemelingen factory area has also suffered, while many sheds in the Gropelinger Freight Yards have been burnt out. Railways have also suffered seriously.

Hamburg.—As in Bremen many areas throughout the town and docks have been destroyed or damaged. Apart from many incidents of H.E. damage in the dock and industrial areas, severe destruction is mainly in the old town and districts east of the Aussen Alster Lake. South-west of the Binnen Alster, 12 to 15 blocks of large business premises and warehouses covering about 12 acres are almost entirely gutted. In the Uhlenhorst, Eilbeck and Wandsbeck districts many buildings have been destroyed and a large number of incidents of damage are scattered throughout these districts. At least three big areas of destruction, the result of 4,000 lb. bombs, are seen in the Steinwarder, Grassbrook and Billwarder districts.

Aachen.—This town of 160,000 inhabitants has suffered most severely, almost entirely by fire. There are three main areas of devastation in the centre of the town constituting 30 per cent. of the town proper. In these areas, amounting to nearly 160 acres, 60 to 70 per cent. of the buildings are destroyed; almost all the remainder are damaged. Municipal and civic buildings and business and commercial properties are principally affected by this damage, but the other parts of the town also suffered considerably.

Münster.—This town has been very severely damaged by fire and blast and many large areas have been gutted. A total of 260 acres has been devastated. Close around the old town are at least six areas of gutted property both commercial and residential, each many acres in extent. In the south-east part of the town five more large areas can be seen. A triangular area south of the Inland Port, some 25 acres in extent, has been devastated by fire and blast and many warehouses and workshops have been destroyed. Very heavy damage was inflicted on the hangars and buildings of the Lodenheide aerodrome.

Many other German towns have suffered in similar fashion to those described above. Among these are the naval ports of Kiel and Wilhelmshaven, in which military and naval targets have been heavily damaged. To a lesser degree both Danzig and Flensburg have items of damage. The inland ports of Duisburg and Mannheim show many heavy scars without having such large areas of concentrated damage as can be seen in either Düsseldorf or Cologne.

The Ruhr, which includes an area of over 450 square miles, has received widespread damage. There are many items of destruction both by fire and blast in all the manufacturing towns, among these being Essen, Oberhausen, Mulheim, Dortmund, Hamorn and Krefeld. In Southern Germany Nuremberg and Augsburg show important damage incidents, 108 acres of the former being damaged on a single night last August. Munich has also received much damage and many incidents of blast damage are found all over the city. Kassel is another town in which there are important incidents of destruction, and mention could be made of many other smaller towns which have suffered from bombing.

It will thus be seen that Bomber Command's labours have not been as fruitless as Dr. Goebbels and his friends would have us believe. Indeed, he is now obliged to change his tune as more and more Germans experience the reality of our raids. While these remain (of course) "absolutely ineffective," they are now invariably described as "terror raids"; hospitals, churches, ancient monuments, women and children are the targets, and those situated as far as possible from war industries and military objectives are always preferred. "The British like attacking small towns which have no defences," announced the *Frankfurter Zeitung*, after our raids on Mainz and its war industries and military depôts—conveniently forgetting that such heavily defended targets as Essen, Cologne, Bremen, Hamburg and Kiel, have received by far the greater part of our effort.

After the raid on the Arado Works and Seaplane Station at Warnemünde (both of which were damaged), the official news declared that this was "an attack on the residential areas of Rostock and Warnemünde." The Press eagerly followed up the announcement: "British prestige flights produce suffering and misery among the German civil population at the points hit, but they have absolutely no military effect. The destruction of centuries-old monuments is regarded by us as an act of vandalism and we do not hesitate to say so." Indeed, German propaganda does not hesitate to describe the majority of our targets by such remarkable phrases as "medieval dream towns."

The Rostock raids gave great opportunities for righteous indignation and foreign press correspondents were informed that the inhabitants of Stralsund had been warned by leaflets that their turn was coming. The Swedish *Dagens Nyheter* published this German report with the shrewd comment: "Stralsund, like Rostock, has its 13th century churches; but it also has machine factories and is the centre of the grain trade. There are manifestly military targets outside Rostock which may also have been hit." They were hit—very severely.

On 5th/6th April the U-Boat Engine (Humboldt-Deutz) Works and the Rhine Harbour were damaged in a raid on Cologne. The Reich Propaganda Office merely announced that "the Hansa City of Cologne was also raided; damage was done to a number of dwelling houses and hospitals in various parts of the city, but all the fires caused were quickly got under control."

After the Propaganda Ministry had begun to recover from the shock of the first Thousand Raids this remarkable impression of our bomber tactics was given to the Berlin correspondent of a Spanish paper: "The large number of aircraft which take off at nightfall from British aerodromes arrive over some German town somewhat in the manner of a travelling circus going from one village to another showing off its latest attraction."

Following the attack on Bremen on 13th/14th September, the *Hambürger Fremdenblatt* sympathetically reviewed the results of "over a hundred large-scale Terror Raids on this city [of Bremen] since the beginning of the war." The usual catalogue of beautiful old buildings, dwelling houses, and so forth was enumerated and summed up as "a picture of senseless destruction without achieving any result which will influence the outcome of the war in any way. During the last raid (the account unguardedly continued) men and women of one works fought the fires without interruption for 24 hours, thus saving their factory; even foreign workers did their share in spite of the fact that oxygen cylinders were bursting all around them." The newspaper does not name this doubtless very beautiful old building, but photographs taken by the P.R.U. show several damaged war factories to which the description could apply.

It is of course to be expected that the regimented German Press and wireless would avoid all reference to vital injuries inflicted by our raids and minimise their effect on production and means of supply. It is not announced, for instance, that German coal production—far from showing an increase—has fallen by 20 per cent. as a result of British bombing; and that the Humboldt-Deutz depôt in Bremen received no parts for U-Boat engines for months after the big raid on Cologne. But realistic descriptions, such as the following one, now frequently appear in the newspapers, warning people what to expect when their city is attacked:

"There is no question of sitting or lying in an air raid shelter, reading a paper or playing games and looking round about every half hour—a Terror-Raid is different from that. The air is full of the drone of engines, of the incessant roar of the Flak, of the whistle and burst of bombs; night has become day owing to the flames and flares. Fires rage in the streets, the heat becomes unbearable, brick dust makes breathing difficult and settles in the eyes, throat and lungs, and over everything is choking smoke. Only he who has strong nerves, is blessed with courage and toughness, is a real man, can overcome these horrors. It is necessary that everybody should accustom himself to the idea of what such a Terror Raid looks like and that everyone, by sternly taking himself in hand, should steel his nerves in order to pass the ordeal in the hour of trial."

Such passages unconsciously betray the very deep concern our raids are causing the Nazi leaders, who now openly confess their inability to withdraw aircraft from the Eastern Front to make even an inadequate reply. How weak these confessions must sound to Germans who remember their former bombastic assurances of the omnipotence of the Luftwaffe and the invulnerability of the Third Reich to air attack.

All the evidence shows that the bombing of Germany is having a pronounced effect on the Nazi war effort; even the barrage of enemy propaganda denying that this is so, is circumstantial evidence of a convincing nature. The number of damaged war factories has grown rapidly during 1942, and it is clear from this fact alone that output of U-Boats, aircraft, tanks, armoured vehicles and munitions of many kinds has been directly affected.

But the results of our raids are not measured only in terms of damaged factories and reduced war production. It is not generally realised that the supply lines of the Axis armies are hardly less vulnerable than those of the Allies ; the heavily burdened German railway system (which has to bear the brunt of the strain) was largely responsible for the breakdown of the campaign in Russia last winter, and the comparative ineffectiveness of the German summer campaign of 1942. The supply of fuel to North Italian industries largely depends on precarious rail transport from the Ruhr. Attack by air is the only method whereby the Allies can obstruct the Axis supply-lines, and there are reliable indications that our bombers have achieved this object on many occasions ; while our minelaying sorties have a complementary effect on German supply routes by sea.

The influence of sustained mass bombing on the morale of the German home front is more difficult to assess, owing to the Gestapo's hold over the civilian population and the expression of opinions. But, in view of the fact that many thousands of workers have lost all their possessions, and life is becoming increasingly grim for large sections of the German people, morale cannot possibly be unaffected. The Nazi Press admitted that 10 per cent. of the workers failed to turn up at their factories after the big raid on Cologne ; the true figure was certainly far higher than officially admitted, and in any case 250 of their factories were severely damaged or destroyed.

There is therefore no doubt whatever that the great efforts of the Bomber Command crews are having a pronounced and far-reaching effect on Germany's capacity to wage war. Never before have we inflicted such serious damage on the Reich as during 1942 ; and no one can doubt that the Germans (now on the defensive from the Arctic to North Africa) desire most passionately to be free from the menace and destruction of our bombs. It is our business to disappoint them, and to ensure that, in 1943, we finish off what has been so well begun.